DOCUMENT RESUME

ED 183 820 CE 024 378

TITLE Military Curricula for Vocational & Technical Education. Veterinary Specialist, Blocks VII-XI, 1-4.

INSTITUTION Air Force Training Command, Sheppart AFB, Tex.; Ohio State Univ., Columbus. National Center for Research in Vocational Education.

SPONS AGENCY Bureau of Occupational and Adult Education (DHEW/OE), Washington, D.C.

PUB DATE 17 Jul 75

NOTE 444p.; Not available in paper copy due to light and broken type. For a related document see CE 024 377.

EDRS PRICE MF01 Plus Postage. PC Not Available from EDRS.

DESCRIPTORS *Animal Husbandry; Behavioral Objectives; Course Descriptions; Curriculum Guides; *Disease Control; *Food and Drug Inspectors; Food Processing Occupations; Food Service Occupations; *Food Standards; Learning Activities; Postsecondary Education; Study Guides; Textbooks; *Veterinary Medicine; Vocational Education; Workbooks

IDENTIFIERS Chickens; Dairy Industry; Eggs; Military Curriculum Project

ABSTRACT

These instructor materials and student texts, study guides, and workbooks for a postsecondary-level course to train veterinary specialists are one of a number of military-developed curriculum packages selected for adaptation to vocational instruction and curriculum development in a civilian setting. It is the second half of a two-part course (see Note) intended to provide training in food inspection; laboratory procedures; subprofessional duties concerning veterinary sciences; sanitary surveillance of food processing, storage, and service facilities; control and epidemiology of zoonotic diseases; and veterinary aspects of disaster medicine. Dealing with poultry and egg inspection, dairy products, miscellaneous foods, food technology, and animal services, this section contains five blocks of instruction covering eighty-eight hours of instruction: Dairy and Dairy Products (2 lessons), Miscellaneous Foods (2 lessons), Food Technology (2 lessons), and Animal Service and Zoonoses Control Activities (4 lesons). Instructor materials include a course chart, Speciality Training, for use in student evaluation, lesson plans, and a plan of instruction detailing unit content, lesson duration, objectives, and support material. Student materials include seven student texts, student workbook, and three study guide/workbooks. Contents are objectives, text readings, review exercises, and laboratory experiments. Commerical texts, military manuals, and audiovisuals are suggested but not provided. (YLB)

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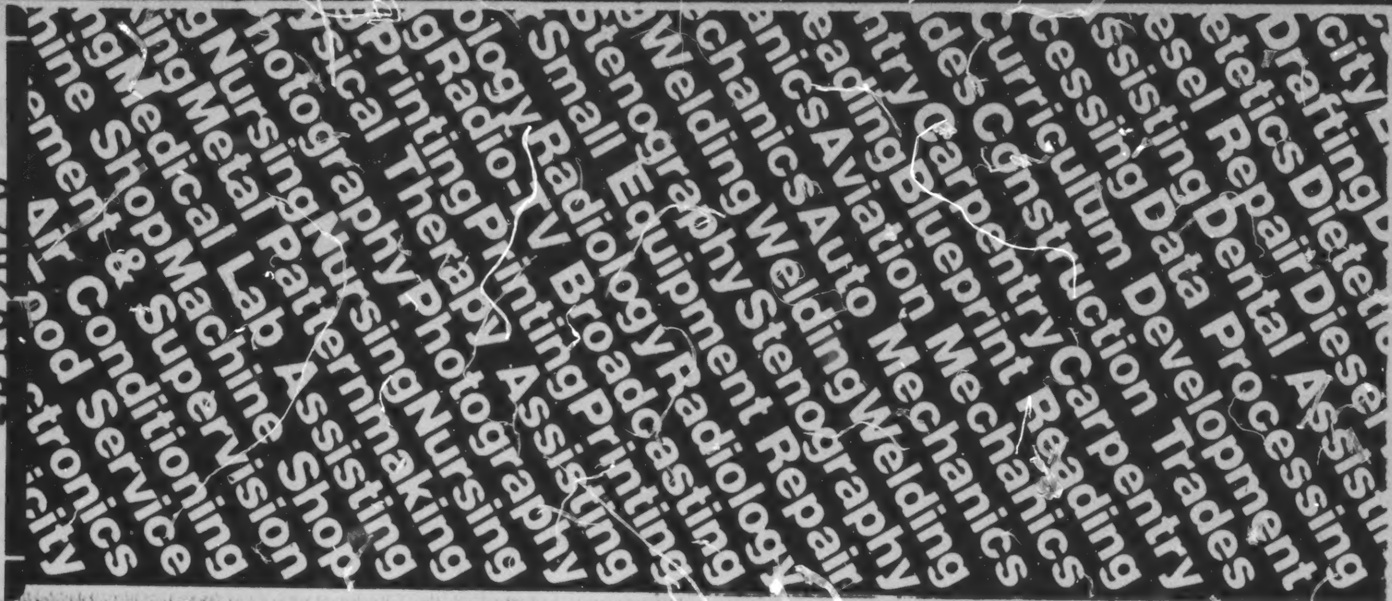
CE 024 378



Military Curricula for Vocational & Technical Education

VETERINARY SPECIALIST

BLOCKS VII - XI

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

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THE NATIONAL CENTER
FOR RESEARCH IN VOCATIONAL EDUCATION
THE OHIO STATE UNIVERSITY

This military technical training course has been selected and adapted by The Center for Vocational Education for "Trial Implementation of a Model System to Provide Military Curriculum Materials for Use in Vocational and Technical Education," a project sponsored by the Bureau of Occupational and Adult Education, U.S. Department of Health, Education, and Welfare.

MILITARY CURRICULUM MATERIALS

The military-developed curriculum materials in this course package were selected by the National Center for Research in Vocational Education Military Curriculum Project for dissemination to the six regional Curriculum Coordination Centers and other instructional materials agencies. The purpose of disseminating these courses was to make curriculum materials developed by the military more accessible to vocational educators in the civilian setting.

The course materials were acquired, evaluated by project staff and practitioners in the field, and prepared for dissemination. Materials which were specific to the military were deleted, copyrighted materials were either omitted or approval for their use was obtained. These course packages contain curriculum resource materials which can be adapted to support vocational instruction and curriculum development.

The National Center Mission Statement

The National Center for Research in Vocational Education's mission is to increase the ability of diverse agencies, institutions, and organizations to solve educational problems relating to individual career planning, preparation, and progression. The National Center fulfills its mission by:

- Generating knowledge through research
- Developing educational programs and products
- Evaluating individual program needs and outcomes
- Installing educational programs and products
- Operating information systems and services
- Conducting leadership development and training programs

FOR FURTHER INFORMATION ABOUT
Military Curriculum Materials
WRITE OR CALL
Program Information Office
The National Center for Research in Vocational Education
The Ohio State University
1960 Kenny Road, Columbus, Ohio 43210
Telephone: 614/486-3655 or Toll Free 800/848-4815 within the continental U.S. (except Ohio)

THE NATIONAL CENTER
FOR RESEARCH IN VOCATIONAL EDUCATION
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Military Curriculum Materials for Vocational and Technical Education

Information and Field Services Division

The National Center for Research in Vocational Education

Military Curriculum Materials Dissemination Is . . .

an activity to increase the accessibility of military-developed curriculum materials to vocational and technical educators.

This project, funded by the U.S. Office of Education, includes the identification and acquisition of curriculum materials in print form from the Coast Guard, Air Force, Army, Marine Corps and Navy.

Access to military curriculum materials is provided through a "Joint Memorandum of Understanding" between the U.S. Office of Education and the Department of Defense.

The acquired materials are reviewed by staff and subject matter specialists, and courses deemed applicable to vocational and technical education are selected for dissemination.

The National Center for Research in Vocational Education is the U.S. Office of Education's designated representative to acquire the materials and conduct the project activities.

Project Staff:

Wesley E. Budke, Ph.D., Director
National Center Clearinghouse

Shirley A. Chase, Ph.D.
Project Director

What Materials Are Available?

One hundred twenty courses on microfiche (thirteen in paper form) and descriptions of each have been provided to the vocational Curriculum Coordination Centers and other instructional materials agencies for dissemination.

Course materials include programmed instruction, curriculum outlines, instructor guides, student workbooks and technical manuals.

The 120 courses represent the following sixteen vocational subject areas:

- Agriculture
- Aviation
- Building & Construction Trades
- Clerical Occupations
- Communications
- Drafting
- Electronics
- Engine Mechanics
- Food Service
- Health
- Heating & Air Conditioning
- Machine Shop
- Management & Supervision
- Meteorology & Navigation
- Photography
- Public Service

The number of courses and the subject areas represented will expand as additional materials with application to vocational and technical education are identified and selected for dissemination.

How Can These Materials Be Obtained?

Contact the Curriculum Coordination Center in your region for information on obtaining materials (e.g., availability and cost). They will respond to your request directly or refer you to an instructional materials agency closer to you.

CURRICULUM COORDINATION CENTERS

EAST CENTRAL
Rebecca S. Douglass
Director
100 North First Street
Springfield, IL 62777
217/782-0759

MIDWEST
Robert Patton
Director
1515 West Sixth Ave.
Stillwater, OK 74704
405/377-2000

NORTHEAST
Joseph F. Kelly, Ph.D.
Director
225 West State Street
Trenton, NJ 08625
609/292-6562

NORTHWEST
William Daniels
Director
Building 17
Airdustrial Park
Olympia, WA 98504
206/753-0879

SOUTHEAST
James F. Shill, Ph.D.
Director
Mississippi State University
Drawer DX
Mississippi State, MS 39762
601/325-2510

WESTERN
Lawrence F. H. Zane, Ph.D.
Director
1776 University Ave.
Honolulu, HI 96822
808/948-7834

VETERINARY SPECIALIST, BLOCKS VII–XI

Classroom Course

Developed by:

United States Air Force

Development and Review Dates

July 11, 1975

Occupational Area:

Agriculture

Target Audiences:

Grades 13-adult

Print Pages:

384

Cost:

$7.75

Availability:

Military Curriculum Project, The Center for Vocational Education, 1960 Kenny Rd., Columbus, OH 43210

Contents:	Type of Materials: Lesson Plans:	Programmed Text:	Student Workbook: No. of pages	Handouts:	Text Materials:	Audio-Visuals:	Instructional Design: Performance Objectives:	Tests:	Review Exercises:	Additional Materials Required:	Type of Instruction: Group Instruction:	Individualized:
Block VII – *Poultry and Egg Inspection*	●	●	20	★	●	★	●	★		★	●	
Block VIII – *Dairy and Dairy Products*	●				●	★	●	★		★	●	
Block IX – *Miscellaneous Foods*	●		11		●	★	●	★		★	●	
Block X – *Food Technology and Military Operational Rations*	●		15		●	★	●	★		★	●	
Block XI – *Animal Service and Zoonoses Control Activities*	●		24		●	★	●	★		★	●	

★ Materials are recommended but not provided.

Expires July 1, 1978

Course Description

This is the second half of a two-part course to train veterinary specialists. The course includes training in food inspection; laboratory procedures; subprofessional duties concerning veterinary sciences; sanitary surveillance of food processing, storage, and service facilities; control and epidemiology of zoonotic diseases; and veterinary aspects of disaster medicine. The previous section contains four blocks of instruction on microbiology, food handling, the food laboratory, and meat and meat products. This section continues with five blocks of instruction covering 88 hours on poultry and egg inspection, dairy products, miscellaneous foods, food technology, and animal services. Students should complete **Veterinary Specialist, Blocks III—VI**, (1-3) before beginning this section.

Block VIII — *Dairy and Dairy Products* has two lessons covering 25 hours of instruction.

Inspection of Diary Processing Facilities (12 hours)
Inspection of Diary Products (13 hours)

Block IX — *Miscellaneous Foods* contains two lessons covering 22 hours of instruction.

Inspection of Fish and Shellfish (11 hours)
Inspection of Fruits and Vegetables (11 hours)

Block X — *Food Technology and Military Operational Rations* has two lessons covering 12 hours of instruction. A third lesson on military operation rations was deleted.

Principles of Food Preservation (9 hours)
Inspection and Storage of Preserved Foods (3 hours)

Block XI — *Animal Service and Zoonoses Control Activities* contains four lessons covering 29 hours of instruction. One lesson was deleted because it discusses military forms.

Veterinary Responsibilities for Animal Service (2 hours)
Government Owned Animals (3 hours)
Subprofessional Clinical Procedures (8 hours)
Identification and Control of Communicable/Zoonotic Diseases (16 hours)

This course contains both teacher and student materials. Printed instructor materials include a course chart; a Specialty Training Standard for use in student evaluation; lesson plans; and a plan of instruction detailing the unit content, duration of the lessons, objectives, and support materials needed. Student materials include seven student texts, one student workbook, and three study guide/workbooks. These materials include objectives, text readings, review exercises and lab experiments.

Several military manuals and commercially produced texts are recommended as references. The materials provided have a definite military orientation and contain numerous forms and procedures which might or might not be of use in the civilian sector. These materials can be used with a large group or adapted for individualized study in veterinary or foods processing courses.

Audiovisuals suggested for use with the entire course but not provided are 43 films, 9 transparency sets, 10 slide sets, and 2 sound/slide programs.

VETERINARY SPECIALIST, BLOCKS VII-XI

Table of Contents

Course Description Page 1
Course Chart Page 3
Specialty Training Standard Page 8
Plan of Instruction Page 19
Lesson Plans Page 49

Block VII - Poultry and Egg Inspection

Poultry Inspection - Student Text 1 Page 75
Egg Inspection - Student Text 2 Page 108
Egg Inspection - Student Text 3 Page 150

Block VIII - Dairy Products

Dairy Products - Workbook Page 186
Dairy Products Inspection - Student Text Page 207

Block IX - Miscellaneous Food

Inspection of Waterfoods - Student Text Page 274
Fruit and Vegetable Inspection - Student Text Page 292
Fruit and Vegetable Inspection - Study Guide and Workbook Page 311

Block X - Food Technology and Military Operational Rations

Food Technology - Student Text Page 316
Food Preservation - Study Guide and Workbook Page 344

Block XI - Animal Service and Zooses Control Activities

Animal Service - Student Text Page 359
Parasitology - Study Guide and Workbook Page 393

CE 024 318

COURSE CHART

NUMBER 3ABR90830

POS CODE EMQ

DATE 25 March 1975

TECHNICAL TRAINING COURSE TITLE
Veterinary Specialist

ATC OPR & APPROVAL DATE
SGHE, 25 March 1975

SUPERSEDES COURSE CHART
3ABR90830
13 February 1975

CENTER OPR
Sheppard/SHCS/MSOX

DEPARTMENT OPR
Department of Veterinary Medicine

COURSE SECURITY CLASSIFICATION
UNCLASSIFIED

LOCATION OF TRAINING
Sheppard AFB, Texas 76311

LENGTH OF TRAINING

Technical Training (Table II) 410 Hours
Related Training (Table III) 46 Hours
456 Total Hours (11 Weeks, 2 Days)

APPLICABLE TRAINING STANDARD
STS 908X0, 25 March 1975

INSTRUCTIONAL DESIGN
Group/Lock Step

REMARKS

Applicable safety is integrated throughout the course.

Effective Date: 7 August 1975 with class 750807. All previously enrolled classes will continue to be governed by course chart dated 13 February 1975.

TABLE I – MAJOR ITEMS OF EQUIPMENT

Veterinary Laboratory Equipment
Centrifuges
Compound Microscopes
Hobart Fat Tester
Egg Candling Kits
Mounted Animal Skeletons
Autoclave
Distilling Apparatus
Water Bath
Food Freezer
Refrigerators
Dishwashing Machine
Bacteriological Incubators

ATC FORM NOV 72 449 PREVIOUS EDITION OBSOLETE.

4

COURSE CHART – TABLE II – TRAINING CONTENT 3ABR90830

NOTE: Include time spent on technical training (TT) (classroom/laboratory (C/L) and complementary technical training (CTT)) and related training (RT). Exclude time spent on individual assistance (remedial instruction). A single entry of time shown for a unit is C/L time. When a double entry is shown, the second entry is CTT time.

HRS PER DAY / WK OF TNG	1 2 3 4 5 6	7 8
1	Course Material - UNCLASSIFIED 34 Hours TT BLOCK I - Veterinary Administration Welcome and Orientation (3 hrs); Medical Service/Veterinary Service Organization (1 hr); Communications Security (1 hr); Subsistence Procurement Systems (5 hrs); Inspection Procedures (18 hrs); Office Management Techniques (4 hrs); Measurement Test and Test Critique (2 hrs) 34 Hours C/L	10 Hours RT See Table III
2 3(1/5)	Course Material - UNCLASSIFIED 32 Hours TT BLOCK II - Technical Inspection Procedures Inspection of Subsistence by Attributes (15 hrs); Concepts of Verification Inspection (2 hrs); COLEQUAP (13 hrs); Measurement Test and Test Critique (2 hrs) 32 Hours C/L	10 Hours RT See Table III
3(4/5)	Course Material - UNCLASSIFIED 26 Hours TT BLOCK III -Microbiology Principles of Microbiology (18 hrs); Microbiology Laboratory (2 hrs); The Microscope (4 hrs); Measurement Test and Test Critique (2 hrs) 26 Hours C/L	10 Hours RT See Table III
4 5(1/5)	Course Material - UNCLASSIFIED 42 Hours TT BLOCK IV - Medical Aspects of Food Handling Organization and Objectives of the Aerospace Medicine Program (2 hrs); Medical Aspects of Insect and Rodent Control, Water Purification, Sewage and Waste Disposal (5/2 hrs); Medical Evaluation of Food Service Facilities (27/4 hrs); Measurement Test and Test Critique (2 hrs) 36 Hours C/L	6 Hours RT See Table III 6 Hours CTT See Table III
	13	

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5

COURSE CHART – TABLE II – TRAINING CONTENT 3ABR90830

NOTE: Include time spent on technical training (TT) (classroom/laboratory (C/L) and complementary technical training (CTT)) and related training (RT). Exclude time spent on individual assistance (remedial instruction). A single entry of time shown for a unit is C/L time. Where a double entry is shown, the second entry is CTT time.

WK OF TNG / HRS PER DAY	1 2 3 4 5 6	7 8
5(4/5)	Course Material - UNCLASSIFIED 30 Hours TT BLOCK V - Food Laboratory Laboratory Analyses of Foods (9/2 hrs); Laboratory Analyses of Food Contact Surfaces and Personal Hygiene of Food Service Personnel (10/4 hrs); Collection and Submission of Laboratory Samples (3 hrs); Measurement Test and Test Critique (2 hrs) 24 Hours C/L	6 Hours CTT See Table III
6 7(3/5)	Course Material - UNCLASSIFIED 66 Hours TT BLOCK VI - Meat and Meat Products Meat Inspection Agencies (2/1 hrs); Anatomy and Physiology of Meat Animals (5/3 hrs); Slaughtering, Processing, and Grading of Meat Animals (17/6 hrs); Processing and Inspection of Veal, Calf, Lamb, Pork, and Cured and Smoked Meats (11/4 hrs); Inspection of Meat and Meat Products (9/4 hrs); Measurement Test and Test Critique (4 hrs) 48 Hours C/L	18 Hours CTT See Table III
7(2/5) 8(3/5)	Course Material - UNCLASSIFIED 43 Hours TT BLOCK VII - Poultry and Egg Inspection Inspection of Poultry and Poultry Products (6 hrs); Egg Formation and Egg Production/Processing Facilities (3/1 hrs); Egg Quality Determination (8/4 hrs); Contract Compliance and Surveillance Inspection (14/5 hrs); Measurement Test and Test Critique (2 hrs) 33 Hours C/L	10 Hours CTT See Table III
8(2/5) 9(3/5)	Course Material - UNCLASSIFIED 35 Hours TT BLOCK VIII - Dairy and Dairy Products Inspection of Dairy Processing Facilities (12/4 hrs); Inspection of Dairy Products (13/4 hrs); Measurement Test and Test Critique (2 hrs) 27 Hours C/L	8 Hours CTT 2 Hours RT See Table III

:6

COURSE CHART – TABLE II – TRAINING CONTENT 3ABR90830

NOTE: Include time spent on technical training (TT) (classroom/laboratory (C/L) and complementary technical training (CTT)) and related training (RT). Exclude time spent on individual assistance (remedial instruction). A single entry of time shown for a unit is C/L time. When a double entry is shown, the second entry is CTT time.

WK OF TNG \ HRS PER DAY	1 2 3 4 5 6	7 8
9(2/5) 10(2/5)	Course Material - UNCLASSIFIED 30 Hours TT BLOCK IX - Miscellaneous Foods Inspection of Fish and Shellfish (11/3 hrs); Inspection of Fruits and Vegetables (11/3 hrs); Measurement Test and Test Critique (2 hrs) 24 Hours C/L	6 Hours CTT See Table III
10(3/5)	Course Material - UNCLASSIFIED 28 Hours TT BLOCK X - Food Technology and Military Operational Rations Principles of Food Preservation (9/4 hrs); Inspection and Storage of Preserved Foods (3/2 hrs); Military Operational Rations (6/2 hrs); Measurement Test and Test Critique (2 hrs) 20 Hours C/L	8 Hours CTT See Table III
11 12(2/5)	Course Material - UNCLASSIFIED 44 Hours TT BLOCK XI - Animal Service and Zoonoses Control Activities Veterinary Responsibilities for Animal Service (2 hrs); Government Owned Animals (3/2 hrs); Subprofessional Clinical Procedures (8/2 hrs); Clinic Management (3/2 hrs); Identification and Control of Communicable/Zoonotic Diseases (16/2 hrs); Measurement Test and Test Critique (2 hrs); Course Critique and Graduation (2 hrs). 36 Hours C/L	8 Hours CTT See Table III 8 Hours RT See Table III

COURSE CHART – TABLE III – SUMMARY OF TRAINING HOURS

TECHNICAL TRAINING (TT)		410 Hours
3ABR90830, Classroom/Laboratory (C/L)	340 Hours	
Complementary Technical Training (CTT) (Assigned Study)	70 Hours	
RELATED TRAINING (RT)		46 Hours
Traffic Safety	14 Hours	
Supplemental Military Training (SMT)	20 Hours	
Commander's Time	4 Hours	
End of Course Appointments, Traffic Safety Predeparture Briefing	8 Hours	
TOTAL		456 Hours

DEPARTMENT OF THE AIR FORCE
Headquarters, US Air Force
Washington DC 20330

STS 908X0
(For AFSCs 90830/50/70)
25 March 1975

VETERINARY SPECIALIST
AND
VETERINARY TECHNICIAN

1. Purpose of this Specialty Training Standard (STS). As prescribed in AFR 3-13, this STS:

a. States in column 1 of attachment 1 the tasks, knowledges, and study references (SR) necessary for airmen to perform duties in the Veterinary ladder of the Airman Medical Career Field. These are based on Specialty Descriptions effective 1 October 1973 in AFM 39-1.

b. Indicates in columns 2A, 3A, and 4A of attachment 1 the minimum proficiency recommended for each task or knowledge for qualification at the 3, 5, and 7 skill level AFSCs. AFM 50-23 is the authority to change the proficiency level during JPG development when the local requirement is different from the skill level shown in this STS.

c. Shows in column 2A of attachment 1 the proficiency attained in Course 3ABR90830 (PDS Code EMQ) described in AFM 50-5. Proficiency code for the minimum proficiency recommended for the 3 skill level AFSC and the proficiency attained in the course is the same.

d. Provides basis for supervisors to plan and conduct individual OJT programs.

e. Provides a convenient record of on-the-job training completed when inserted in AF Form 623, "On-the-Job Training Record," and maintained in accordance with AFM 50-23.

2. Proficiency Code Key. Attachment 1 contains the Proficiency Code Key used to show proficiency level.

3. Career Development Channel of OJT. Satisfactory completion of CDC 90850 is mandatory for personnel training to AFSC 90850. Personnel training to AFSC 90870 will obtain knowledge training by using applicable study references listed in this STS and fulfill management training requirements specified in AFM 50-23. (See ECI Catalog and Guide for current CDC identification number for ordering purposes.)

4. Study Guidance for Weighted Airman Promotion System (WAPS). Specialty Knowledge Tests (SKTs) for promotion to E-5 are based on 5 skill level knowledge requirements. SKTs for promotion to E-6 and E-7 are based on 7 skill level knowledge requirements. SKT questions are based primarily on Career Development Courses (CDCs). However, some questions may be drawn from other references listed in this Specialty Training Standard. The CDCs for SKT study are maintained in the WAPS Study Reference Library. Other references listed should be available in the work area. Individual responsibilities are outlined in AFM 35-8, chapter 19, paragraph 19-3g.

5. Recommendations. Report to ATC/SG unsatisfactory performance of individual graduates or inadequacies of this STS. Refer to specific paragraphs of this STS. See AFR 50-38.

BY ORDER OF THE SECRETARY OF THE AIR FORCE

OFFICIAL

DAVID C. JONES, General, USAF
Chief of Staff

JACK R. BENSON, Colonel, USAF
Director of Administration

2 Attachments
1. Qualitative Requirements
2. SKT Review Reference

Supersedes STS 908X0, 24 January 1972; Change 1, 5 December 1972; Change 2, 12 February 1973; Change 3, 14 December 1973; Change 4, 11 April 1974

THIS BLOCK IS FOR IDENTIFICATION PURPOSES ONLY

TRAINEE

NAME	INITIALS (In Writing)	GRADE
ORGANIZATION		

IMMEDIATE SUPERVISOR'S NAME AND INITIALS (In Writing)

N I	N I
N I	N I

QUALITATIVE REQUIREMENTS

PROFICIENCY CODE KEY

	SCALE VALUE	DEFINITION: The Individual
TASK PERFORMANCE LEVELS	1	Can do simple parts of the task. Needs to be told or shown how to do most of the task. (EXTREMELY LIMITED)
	2	Can do most parts of the task. Needs help only on hardest parts. May not meet local demands for speed or accuracy. (PARTIALLY PROFICIENT)
	3	Can do all parts of the task. Needs only a spot check of completed work. Meets minimum local demands for speed and accuracy. (COMPETENT)
	4	Can do the complete task quickly and accurately. Can tell or show others how to do the task. (HIGHLY PROFICIENT)
* TASK KNOWLEDGE LEVELS	a	Can name parts, tools, and simple facts about the task. (NOMENCLATURE)
	b	Can determine step by step procedures for doing the task. (PROCEDURES)
	c	Can explain why and when the task must be done and why each step is needed. (OPERATING PRINCIPLES)
	d	Can predict, identify, and resolve problems about the task. (COMPLETE THEORY)
** SUBJECT KNOWLEDGE LEVELS	A	Can identify basic facts and terms about the subject. (FACTS)
	B	Can explain relationship of basic facts and state general principles about the subject. (PRINCIPLES)
	C	Can analyze facts and principles and draw conclusions about the subject. (ANALYSIS)
	D	Can evaluate conditions and make proper decisions about the subject. (EVALUATION)

- EXPLANATIONS -

* A task knowledge scale value may be used alone or with a task performance scale value to define a level of knowledge for a specific task. (Examples: b and 1b)

** A subject knowledge scale value is used alone to define a level of knowledge for a subject not directly related to any specific task, or for a subject common to several tasks.

- This mark is used alone instead of a scale value to show that no proficiency training is provided in the course, or that no proficiency is required at this skill level.

X This mark is used alone in course columns to show that training is not given due to limitations in resources.

1	PROFICIENCY LEVEL, PROGRESS RECORD AND CERTIFICATION								
	2. 3 Skill Level			3. 5 Skill Level			4. 7 Skill Level		
TASKS, KNOWLEDGES AND STUDY REFERENCES	A AFSC Crs	B Date OJT Started	C Date Completed & Trainee's Supervisor's Initials	A AFSC	B Date OJT Started	C Date Completed & Trainee's Supervisor's Initials	A AFSC Crs	B Date OJT Started	C Date Completed & Trainee's Supervisor's Initials
NOTE: Users may annotate lists of SRs to identify current references pending STS revision.									
1. CAREER LADDER PROGRESSION									
SR: AFP 39-7; AFR 39-4									
a. The airman career ladder and educational opportunities	B			C			C		
SR: AFMs 39-1 (atch 52, vol II), 213-1; AFVA 39-1									
b. Progression in career ladder 908X0	A			B			C		
SR: AFM 39-1 (atch 52, vol II); AFR 35-1; AFVA 39-1									
c. Duties of AFSCs 908X0, 90891									
SR: AFM 39-1 (atch 52, vol II)									
(1) AFSCs 90870, 90891	A			B			C		
(2) AFSCs 90830, 90850	B			C			C		
d. Mission, organization, development, and function of the Medical Service and the Veterinary Service	A			B			C		
SR: AFR 20-28									
2. DISASTER PREPAREDNESS MEDICAL CARE AND FIRST AID PROCEDURES									
SR: AFMs 160-12 (chap 1), 160-34 (chap 5 and 9), 160-37									
a. Manage shock	2b/-			3c			3c		
b. Maintain effective respiration	2b/-			3c			3c		
c. Control hemorrhage	2b/-			3c			3c		
d. Perform emergency treatment of wounds	2b/-			3c			3c		
e. Manage fractures, burns, and injuries from chemical agents	2b/-			3c			3c		
f. Perform methods of hand and litter carries	2b/-			3c			3c		
g. Load and unload vehicles utilized for transportation of patients	2b/-			3c			3c		
h. Maintain military sanitation	a/-			1b			2b		

NO ADVANCED COURSE

TASKS, KNOWLEDGES AND STUDY REFERENCES	PROFICIENCY LEVEL, PROGRESS RECORD AND CERTIFICATION								
	2. 3 Skill Level			3. 5 Skill Level			4. 7 Skill Level		
1	A AFSC/Crs	B Date OJT Started	C Date Completed & Trainee's Supervisor's initials	A AFSC	B Date OJT Started	C Date Completed & Trainee's Supervisor's initials	A AFSC/Crs	B Date OJT Started	C Date Completed & Trainee's Supervisor's initials
3. COMMUNICATIONS SECURITY (TRANSMISSION SECURITY)									
SR: AFRs 205-1, 205-7									
a. Identify information as classified, unclassified, or of possible intelligence value	b			b			b		
b. Identify information as Top Secret, Confidential or For Official Use Only	b			b			b		
c. Select and recommend mode of transmission dictated by security and expediency required	b			b			b		
d. Observe security precautions involved in communications	b			b			b		
4. SUPERVISION AND TRAINING									
a. Supervision									
(1) Evaluate performance of personnel, counsel, and complete appropriate rating forms	-			2b			4c	NO ADVANCED COURSE	
SR: AFMs 39-1 (atch 52, vol II), 39-62									
(2) Program work assignments for veterinary personnel	-			2b			4c		
SR: AFMs 39-1 (atch 52, vol II), 50-20									
(3) Prepare reports and correspondence, maintain files, and keep records related to veterinary service activities	2b			3c			4c		
SR: AFMs 10-1, 12-20, 12-50 (chap 1, 2, 3, and 10 (table 163-11)); AFRs 5-31, 13-1, 163-2, 163-5, 163-11; TA 9D4; Medical Materiel Catalog; DPSC Subsistence Inspection Manual; Guide for Subsistence Publications, Air Force Logistics Command (AFLC)									
(4) Responsibilities of veterinary noncommissioned officers	-			C			D		
SR: AFM 39-1 (atch 52, vol II); AFR 39-6									
(5) USAF Graduate Evaluation Program	-			C			C		
SR: AFR 50-38									
b. Training									

1. TASKS, KNOWLEDGES AND STUDY REFERENCES	2. 3 Skill Level A AFSC Crs	2. 3 Skill Level B Date OJT Started	2. 3 Skill Level C Date Completed & Trainee's Supervisor's Initials	3. 5 Skill Level A AFSC	3. 5 Skill Level B Date OJT Started	3. 5 Skill Level C Date Completed & Trainee's Supervisor's Initials	4. 7 Skill Level A AFSC/Crs	4. 7 Skill Level B Date OJT Started	4. 7 Skill Level C Date Completed & Trainee's Supervisor's Initials
4b(1) Orient newly assigned personnel and make work assignments	-			2b			4c		
SR: AFMs 39-1 (atch 52, vol II), 50-20									
(2) Plan and conduct veterinary personnel training and maintain appropriate records	-			1b			3c		
SR: AFMs 39-1 (atch 52, vol II), 50-5, 50-20, 50-23									
(3) Utilize sound principles and techniques of instruction in veterinary training programs	-			2b			3c		
SR: AFMs 39-1 (atch 52, vol II), 50-23									
5. ENVIRONMENTAL SAFETY								NO ADVANCED COURSE	
SR: AFR 127-101 (chap 14)									
(a) Principles of general safety	B			C			C		
(b) Safety precautions during job performance	B			C			C		
6. PUBLICATIONS									
(a) Use indexes to locate official publications	1a/-			3c			3c		
SR: AFRs 0-2 Series and 5-4									
(b) Use official publications specifically pertaining to veterinary service activities	2b			3c			4c		
SR: AFMs 10-1, 12-20, 12-50 (chap 1, 2, 3, and 10 (table 163-11)); AFRs 5-31, 11-1, 163-2, 163-5, 163-11, TA 9D4; Medical Materiel Catalog; Defense Personnel Support Center (DPSC) Subsistence Inspection Manual; Guide for Subsistence Publications, Air Force Logistics Command (AFLC)									
7. VETERINARY MATERIEL PROCEDURES									
SR: AFM 67-1 (part II, vol 1); AFR 163-11									
a. Materiel procedures to include classification, identification, and budgeting	A			B			C		
b. Use indexes and supply catalogs	1a			2c			3c		
c. Prepare requests for issue and turn-in of supplies and equipment	1a			2c			3c		

TASKS, KNOWLEDGES AND STUDY REFERENCES 1.	PROFICIENCY LEVEL, PROGRESS RECORD AND CERTIFICATION 2. 3 Skill Level A AFSC/Crs	B Date OJT Started	C Date Completed & Trainee's Supervisor's Initials	3. 5 Skill Level A AFSC	B Date OJT Started	C Date Completed & Trainee's Supervisor's Initials	4. 7 Skill Level A AFSC/Crs	B Date OJT Started	C Date Completed & Trainee's Supervisor's Initials
7d. Property accountability and responsibility	A			B			C		
e. Report of survey system	A			B			C		
SR: AFM 177-111									
8. VETERINARY PROFESSIONAL RELATIONSHIPS									
SR: AFR 160-34 (chap 1); AFR 30-30									
a. Maintain professional standards of conduct	1b/b			3c			3c		
b. Promote good professional relations	1b/b			3c			3c		
c. Perform duties with a high standard of ethical conduct	1b/b			3c			3c		
9. VETERINARY STATISTICAL PROCEDURES									
SR: AFRs 74-10, 163-11; DPSC Subsistence Inspection Manual (sec 212.1, 216.2, 225.2, 225.3, 225.9); Air Force Services Office, COLEQUAP Handbook; Military Standard (MIL STD) 105									
a. Prepare sampling plans for inspection of subsistence items by use of statistical methods	2b			3c			4c		
b. Conduct inspection of subsistence using statistical methods	2b			3c			4c		
c. Assist in evaluation of contractor inspection systems	1a			2b			3c		
d. Perform verification inspections	1a			2b			4c	NO ADVANCED COURSE	
e. Prepare and complete records and reports pertaining to subsistence inspection by attributes and verification inspection	2b			3c			4c		
f. Perform COLEQUAP inspections	2b			3c			4c		
10. MICROBIOLOGY									
SR: Recommended Methods for the Microbiological Examination of Foods, American Public Health Association; Official Methods of Analysis of the Association of Official Agricultural Chemists (AOAC), (chap 15)									
a. Principles of microbiology as they pertain to food spoilage, food establishment sanitation, and control of zoonoses	A			B			C		
b. Perform microscopic examinations	1a			2b			3c		

1. TASKS, KNOWLEDGES AND STUDY REFERENCES	PROFICIENCY LEVEL, PROGRESS RECORD AND CERTIFICATION								
	2. 3 Skill Level			3. 5 Skill Level			4. 7 Skill Level		
	A AFSC Crs	B Date OJT Started	C Date Completed & Trainee's Supervisor's Initials	A AFSC	B Date OJT Started	C Date Completed & Trainee's Supervisor's Initials	A AFSC/Crs	B Date OJT Started	C Date Completed & Trainee's Supervisor's Initials
10c. Accomplish disinfection and/or sterilization of materials and/or equipment	a			3c			4c		
d. Collect, prepare, and forward specimens for laboratory analyses; prepare and submit correspondence requesting same	a			3b			4c		
e. Perform chemical and bacteriological laboratory procedures of food samples	2			2b			3b		
11. FOOD TECHNOLOGY									
SR: AFMs 145-1 (chap 5, 6, and 7), 163-3, 163-8; AFRs 163-2 (chap 3), 163-9, 163-11; DPSC Subsistence Inspection Manual (4155.7); Current or applicable specifications and deviation lists; Applicable DPSC clauses; Applicable military standards									
a. Common food preservation processes and storage procedures	A			B			C		
b. Inspect preserved foods	1a			2b			4c	NO ADVANCED COURSE	
c. Inspect foods for proper packaging, packing, and marking	1a			2b			4c		
d. Inspect military operational rations	1a			2b			4c		
12. FISH AND SHELLFISH INSPECTION									
SR: AFR 163-2 (sec 12-14, para 5); Current or applicable specifications and deviation lists; Applicable DPSC clauses; US Standards for Grades for Frozen Waterfoods, US Department of Commerce (USDC); Guide to Federally Inspected Fishery Products, USDC									
a. Inspect fish and shellfish for quality, wholesomeness, and contract compliance	1a			2b			4c		
b. Inspect commercial seafood establishments for sanitary standards compliance	1a/a			2b			3c		
13. PRODUCTION AND INSPECTION OF DAIRY PRODUCTS									
SR: AFM 74-15 (app A); AFRs 163-2 (chap 2 and 3), 163-7, 163-11; Current specifications, deviation lists, and other publications referenced therein; Applicable DPSC clauses, Grade A pasteurized milk ordinance; Standard Methods for the Examination of Dairy Products, American Public Health Association (chap 4, 5, 6, 7, 18, and 19)									
a. Inspect dairy processing facilities	1a/a			2b			3c		
b. Inspect dairy products	1a			2b			4c		
c. Accomplish laboratory analyses of dairy products	1a			2b			3c		
d. Interpret results of dairy product analyses	2b			3c			4c		

1. TASKS, KNOWLEDGES AND STUDY REFERENCES	PROFICIENCY LEVEL, PROGRESS RECORD AND CERTIFICATION 2. 3 Skill Level A AFSC Crs	 B Date OJT Started	 C Date Completed & Trainee's Supervisor's Initials	3. 5 Skill Level A AFSC	 B Date OJT Started	 C Date Completed & Trainee's Supervisor's Initials	4. 7 Skill Level A AFSC/Crs	 B Date OJT Started	 C Date Completed & Trainee's Supervisor's Initials
14. POULTRY INSPECTION									
SR: AFR 163-2; Current specifications and deviation lists; applicable DPSC clause: Regulations Governing the Grading and Inspection of Poultry and Edible Products and US Classes, Standards, and Grades with Respect Thereto, USDA									
a. Inspect poultry processing facilities	1a/a			2b			3c		
b. Inspect poultry and poultry products for wholesomeness and contract compliance	1a			2b			4c		
c. Perform surveillance inspections of poultry and poultry products	1a			2b			4c		
15. EGG INSPECTION									
SR: AFR 163-2; Current specifications and deviation lists; Applicable DPSC clauses: Regulations Governing the Grading of Shell Eggs and US Standards, Grades, and Weight Classes for Eggs, USDA; Regulations Governing the Grading and Inspection of Shell Eggs, USDA; Egg Grading Manual, USDA; DPSC Subsistence Inspection Manual (sec 213.2 and 213.4); List of Plants Operating Under USDA Poultry and Egg Inspection and Grading Programs, USDA									
a. Determine quality of eggs	2b			3c			4d		
b. Determine contract compliance of eggs and egg products	2a			3b			4c		
c. Accomplish surveillance inspections of eggs and egg products and make appropriate recommendations pertaining to same	2b			3c			4c	NO ADVANCED COURSE	
d. Inspect egg producing and processing facilities	1a/a			2b			3c		
16. MEAT INSPECTION									
SR: AFM 163-4; AFR 163-2; Current specifications and deviation lists; Applicable DPSC articles and clauses; Service and Regulatory Amendment #99, USDA; DPSC Subsistence Inspection Manual; Meat Buyer's Guide to Standardized Meat Cuts, National Association of Meat Purveyors; Meat Buyer's Guide to Portion Control Meats, National Association of Meat Purveyors									
a. Scope of meat inspection services involved in military procurement	A			B			C		
b. Identify anatomical features, terminology, and practices related to meat products	1a			2b			4c		
c. Inspect and verify meat products to determine wholesomeness and contract compliance	1a			2b			4c		
d. Inspect meat processing facilities to determine sanitary compliance	1a/a			2b			3c		
e. Perform surveillance inspection of meat and meat products	1a			2b			4c		

1. TASKS, KNOWLEDGES AND STUDY REFERENCES	PROFICIENCY LEVEL, PROGRESS RECORD AND CERTIFICATION								
	2. 3 Skill Level			3. 5 Skill Level			4. 7 Skill Level		
	A AFSC/Crs	B Date OJT Started	C Date Completed & Trainee's Supervisor's Initials	A AFSC	B Date OJT Started	C Date Completed & Trainee's Supervisor's Initials	A AFSC/Crs	B Date OJT Started	C Date Completed & Trainee's Supervisor's Initials
16f. Determine procedures for evaluation and decontamination of food animals exposed to nuclear, biological, or chemical agents	-			2c			3c		
17. FRUIT AND VEGETABLE INSPECTION									
SR: AFM 145-1; AFR 163-2; Current specifications; Applicable DPSC clauses; US Standards for Fresh Fruits and Vegetables, USDA									
a. Basic botanical anatomy and physiology	A			B			B		
b. Recommend proper practices and procedures for handline and storing fruits and vegetables	1a			3b			4c		
c. Inspect fruits and vegetables for identity and condition	1a			2b			4c		
18. VETERINARY SUPPORT OF ENVIRONMENTAL HEALTH ACTIVITIES									
SR: AFMs 145-1, 161-10, 161-33, 163-8; AFRs 163-9, 163-11									
a. Organization and objectives of the Aerospace Medicine Program	B			B			C	NO ADVANCED COURSE	
b. Basic medical aspects of insect and rodent control, water purification, and sewage and waste disposal	B			C			C		
c. Accomplish routine medical evaluations of food processing, food storage, and/or food serving facilities (including flight feeding facilities and vending machine operations) and make appropriate verbal and written recommendations in regards to conditions noted	2b			3c			4d		
d. Basic principles involving the etiology and control of food-borne illnesses	A			B			C		
e. Assist in investigating outbreaks of food-borne illnesses	-			2b			3c		
f. Assist in training food handlers in medical aspects of food processing sanitation	-			3b			4c		
g. Inspect military air contract carrier food service operations	-			3c			4c		
h. Inspect military aircraft for sanitation	-			3c			4c		
19. ANIMAL SERVICE AND ZOONOTIC DISEASE CONTROL									
SR: AFMs 125-5 (chap 4, vol IO, 160-12 (chap 1), 160-37, 160-48; AFRs 125-9, 161-4, 163-4, 163-11, 168-10; AFP 163-10 (sec A & B)									

1. TASKS, KNOWLEDGES AND STUDY REFERENCES	PROFICIENCY LEVEL, PROGRESS RECORD AND CERTIFICATION								
	2. 3 Skill Level			3. 5 Skill Level			4. 7 Skill Level		
	A AFSC/Crs	B Date OJT Started	C Date Completed & Trainee's Supervisor's Initials	A AFSC	B Date OJT Started	C Date Completed & Trainee's Supervisor's Initials	A AFSC/Crs	B Date OJT Started	C Date Completed & Trainee's Supervisor's Initials
19a. Assist in the zoonoses control program	1a/a			3c			4c		
b. Assist in the veterinary care, treatment, and management of government owned animals	1a/a			3c			4c		
c. Give subprofessional advice related to animal service activities	a			1b			3c		
d. Prepare reports and maintain records of supplies and equipment that pertain to veterinary care of privately owned animals	1a			3b			4c		
e. Prepare reports and maintain records and supplies pertaining to government owned animals	1a			3b			4c		
f. Perform laboratory procedures related to control of animal and zoonotic diseases	2b			3c			4c NO ADVANCED COURSE		
g. Determine procedures for evaluation and decontamination of military working dogs exposed to nuclear, biological, or chemical agents	-			2c			3c		

WAPS Cycle, 76B/77A (1 Jun 75-31 May 76)

SKT REVIEW REFERENCES

1. This attachment identifies review references for the Specialty Knowledge Test (SKT) under the Weighted Airman Promotion System (WAPS). The basic information needed for the SKT is covered in the Career Development Course (CDC). Other references are cited when the CDC requires supplementation to ensure currency and completeness of coverage or where no CDC exists. The attachment identifies the specific career field ladder by AFSCs and its associated Air Force Personnel Tests (AFPTs) by AFPT number.

2. Reference listings are limited to the basic reference. Amendments, revisions, and changes are considered a part of the basic reference. If publications are superseded or replaced by other publications, the latter should be regarded as part of the review references. If CDCs and other listed study references are in conflict, the later-dated reference takes precedence.

AFSCs: 90830/50/70 - Veterinary Specialist/Technician

AFPTs: 90850/70

REVIEW REFERENCES	FOR PROMOTION TO	
	E-5	E-6/E-7
*CDC 90850	X	X
AFM 74-15		
Sections 1 and 3		X
AFM 145-1, Change 1		
Chapters 2, 4, and 5		X
AFR 163-2		
Chapter 2		X
AFR 163-4		X
AFM 163-8		
Chapters 1, 2, 3, 4 and Attachment 1		X

*See index of ECI study reference material for the applicable WAPS testing cycle.

POI 3ABR90830

(PDS Code EMQ)

PLAN OF INSTRUCTION
(Technical Training)

1-4

VETERINARY SPECIALIST

SHEPPARD TECHNICAL TRAINING CENTER

11 July 1975 - Effective 7 August 1975 with Class 750807

20

LIST OF CURRENT PAGES

This POI consists of 53 current pages issued as follows:

Page No.	Issue
Title	Original
A	Original
i	Original
1 thru 43	Original
Annex (7 pages)	Original

DISTRIBUTION: AFMPC/SGE-2; ATC/SGHE-2; AUL-1; CCAF/AY-2; Sheppard: SGPM/200-1; MSOR-1; MSOX-11; MSDV-55

DEPARTMENT OF THE AIR FORCE
School of Health Care Sciences, USAF
Sheppard Air Force Base, Texas 76311

PLAN OF INSTRUCTION 3ABR90830
(PDS Code EMO)
11 July 1975

FOREWORD

1. PURPOSE. This plan of instruction prescribes the qualitative requirements for Course Number 3ABR90830, Veterinary Specialist, in terms of criterion objectives presented by units/modules of instruction, and shows duration, correlation with the Training Standard, support materials, and instructional guidance. It was developed under the provisions of ATCR 50-5, Instructional System Development and ATCR 52-7, Plans of Instruction.

2. COURSE DESCRIPTION. This 11 week, 2 day course trains airmen to perform duties prescribed in AFM 39-1 for Veterinary Specialist, AFSC 90830. Training includes food inspection, laboratory procedures, subprofessional duties concerning veterinary sciences, administrative forms and procedures, sanitary surveillance of food processing and storage establishments and food service facilities, control and epidemiology of zoonotic diseases and the veterinary aspects of disaster medicine. In addition, related training consists of traffic safety, supplemental military training (SMT), commander's time, end of course appointments, and a traffic safety predeparture briefing.

3. EQUIPMENT ALLOWANCE AND AUTHORIZATION. Training equipment required to conduct this course, and for which accountability must be maintained is found in the Report of Medical and Non-Medical In-Use Equipment and is listed under custody account No. 28555A.

NOTE: Group size is shown in parentheses after equipment listed in column 3 of numbered pages of this POI.

4. MULTIPLE INSTRUCTOR REQUIREMENTS. Units of instruction which require more than one instructor per instructional group are identified in the multiple instructor annex to this POI.

5. REFERENCES. This plan of instruction is based on SPECIALTY TRAINING STANDARD 908X0, 25 March 1975, and Course Chart 3ABR90830, 25 March 1975.

6. OVERLAP DURING PHASE-IN. This POI is to be effective with class 750807. Classes entering prior to that date will continue under the previous POI.

FOR THE COMMANDER

LORNE A. DAVIS
Chief, Training Operations Division

Supersedes Plan of Instruction 3ABR90830, 17 May 1974
OPR: Department of Veterinary Medicine
DISTRIBUTION: Listed on Page A

MODIFICATIONS

Pages 1-24 of this publication has (have) been deleted in adapting this material for inclusion in the "Trial Implementation of a Model System to Provide Military Curriculum Materials for Use in Vocational and Technical Education." Deleted material involves extensive use of military forms, procedures, systems, etc. and was not considered appropriate for use in vocational and technical education.

PLAN OF INSTRUCTION

COURSE TITLE
Veterinary Specialist

BLOCK TITLE
Poultry and Egg Inspection

UNITS OF INSTRUCTION AND CRITERION OBJECTIVES 1	DURATION (HOURS) 2	SUPPORT MATERIALS AND GUIDANCE 3
1. Inspection of Poultry and Poultry Products	6	

1. Inspection of Poultry and Poultry Products

a. Identify the appropriate standards for performing sanitary inspection of poultry processing facilities.

b. Given applicable references, documents, and standards, verify grade and condition of selected poultry samples. Satisfactory achievement consists of attaining a score of not less than 70 percent when scored according to checklist 3ABR90830-VII-1b.

Duration: 6 (1) (5)

Column 1 Reference	STS Reference
1a	14a
1b	14b, 14c

Instructional Materials
ST 3ABR90830-VII-1, Poultry Inspection
FED-SPEC: PP-C-248, Chickens Chilled and Frozen (Ready-To-Cook)
USDA, Poultry Grading Manual

Audio Visual Aids
16 mm Film - TF 1-8151 - Poultry Processing Inspection (18 min)
35 mm Slides - Poultry Series
Transparencies - Poultry Series

Training Equipment
Training Aid, (Poultry Skeleton) (15)
Training Aid, (Poultry Samples) (15)

Training Methods
Lecture (5 hrs)
Performance (1hr)

Instructional Environment/Design
Classroom (5 hrs)
Laboratory (1 hr)
Group/Lock Step

Instructional Guidance
Discuss anatomical and physiological features of significance in conducting poultry inspections. Explain poultry processing procedures and the public health significance of antemortem and postmortem inspections, placing emphasis on the epidemicity of salmonellosis. Discuss and demonstrate the various intricacies of poultry grading requirements. Explain the determination of approved sources of poultry. Discuss contractual documents and their use in determining sample size and selection and contract compliance.

PLAN OF INSTRUCTION (Continued)

UNITS OF INSTRUCTION AND CRITERION OBJECTIVES 1	DURATION (HOURS) 2	SUPPORT MATERIALS AND GUIDANCE 3
		Each student will identify and verify the condition and grade of fresh poultry and make recommendations as to the disposition of poultry and poultry products.
2. Egg Formation and Egg Production/Processing Facilities a. Identify the anatomy and physiology of the avian reproductive tract, egg formation, and egg structures. b. Identify the appropriate standards for sanitary inspection of egg producing and processing facilities.	4 (3/1)	Column 1 Reference STS Reference 2a 15a 2b 15d Instructional Materials ST 3ABR90830-VII-2, Egg Inspection Audio Visual Aids 16 mm Film - FLC 6/73, Formation of the Egg (10 Min) Transparencies, Avian Egg Series Training Methods Lecture (2 hrs) Discussion (1 hr) Outside Assignments (1 hr) Instructional Environment/Design Classroom (3 hr[illegible] Home Study (1 [illegible] Group/Lock St[illegible] Instructional Guidance By using a 16 mm film (Formation of the Egg) and transparencies, discuss the anatomy and physiology of the avian reproductive system and egg formation. Students are then provided information regarding sanitary requirements for egg producing and processing facilities and procedures to be followed in their inspection.
3. Egg Quality Determination a. Given necessary equipment, forms, references, standards and simulated exercises, determine the quality of a sample of eggs and complete the required inspection reports.	12 (8/4)	Column 1 Reference STS Reference 3a 15a Instructional Materials ST 3ABR90830-VII-2 PT 3ABR90830-VII-3, Egg Inspection

PLAN OF INSTRUCTION NO. 3ABR90830	DATE 11 JUL [illegible]	BLOCK NO. VII	PAGE NO. 26

PLAN OF INSTRUCTION (Continued)

UNITS OF INSTRUCTION AND CRITERION OBJECTIVES 1	DURATION (HOURS) 2	SUPPORT MATERIALS AND GUIDANCE 3
Satisfactory achievement consists of attaining a score of not less than 70 percent when scored according to checklist 3ABR90830-VII-3a.		DPSC Manual 4155.6, Subsistence Inspection Manual Shell Egg Grading Percentage Tables DD Form 1237, Report of Inspection of Shell Eggs **Audio Visual Aids** Transparencies - Shell Egg Series 35 mm Slides - Shell Egg Series 16 mm Film - FTA 427, Fundamentals of Egg Candling (8 min) **Training Equipment** Egg Inspection Laboratory (15) Egg Inspection Kit (1) Egg Air Cell Measuring Gauges (1) Training Aid, (Case of Procurement I Eggs) (15) **Training Methods** Lecture (1 hr) Discussion (2 hrs) Performance (5 hrs) Outside Assignments (4 hrs) **Instructional Environment/Design** Classroom (3 hrs) Laboratory (5 hrs) Home Study (4 hrs) Group/Lock Step **Instructional Guidance** Instructor will use a 16 mm film (Fundamentals of Egg Candling) and wooden eggs to demonstrate the correct procedures for determining quality of individual eggs. Utilizing the egg candling laboratory, the students will then practice this technique. Under the guidance of one instructor per eight students, students determine the Quality of a sample of eggs that have been pregraded by the primary instructor. Students will then record data on the required inspection reports.

PLAN OF INSTRUCTION NO. 3ABR90830	DATE 11 JUL [illegible]	BLOCK NO. VII	PAGE NO. 27

PLAN OF INSTRUCTION (Continued)

UNITS OF INSTRUCTION AND CRITERION OBJECTIVES 1	DURATION (HOURS) 2	SUPPORT MATERIALS AND GUIDANCE 3
4. Contract Compliance and Surveillance Inspection a. Given necessary references and simulated exercises (including inspection results from egg quality determination), correctly determine contract compliance and recommend proper disposition of shell eggs in accordance with the DPSC Subsistence Inspection Manual. Satisfactory achievement consists of attaining a score of not less than 70 percent when scored according to checklist 3ABR90830-VII-4a.	19 (14/5)	Column 1 Reference 4a — STS Reference 15b, 15c Instructional Materials ST 3ABR90830-VII-2 DPSC Manual 4155.6 - Subsistence Inspection Manual Shell Egg Graders Percentage Tables DD Form 1237 - Report of Inspection of Shell Eggs Audio Visual Aids Transparencies, Contract Compliance and Surveillance Inspection Series Training Methods Lecture (8 hrs) Performance (6 hrs) Outside Assignments (5 hrs) Instructional Environment/Design Classroom (8 hrs) Laboratory (6 hrs) Home Study (5 hrs) Group/Lock Step Instructional Guidance Utilizing transparencies and the DPSC Subsistence Inspection Manual, instructor demonstrates procedure for determining acceptability and contract compliance of a simulated lot of shell eggs. Students then complete exercises relating to same and make appropriate recommendations pertaining to disposition of the eggs. Exercises will include data from eggs at time of receipt and from eggs in storage.
5. Measurement Test and Test Critique	2	

PLAN OF INSTRUCTION	COURSE TITLE Veterinary Specialist
BLOCK TITLE Dairy and Dairy Products	

UNITS OF INSTRUCTION AND CRITERION OBJECTIVES 1	DURATION (HOURS) 2	SUPPORT MATERIALS AND GUIDANCE 3
1. Inspection of Dairy Processing Facilities a. Identify appropriate standards for inspection of dairy processing facilities.	16 (12/4)	Column 1 Reference 1a — STS Reference 13a Instructional Materials ST 3ABR90830-VIII-1, Dairy Products Inspection MIL-STD 668B, Minimum Sanitary Standards for Food Plants WB 3ABR90830-VIII-1, Dairy Products HO 3ABR90830-VIII-1, High Temperature, Short-Time Pasteurizer Audio Visual Aids Transparencies, Dairy Series 35 mm Slides, Dairy Series 16 mm Film - FLC 13-136, Milk and Public Health (10 Min) Training Methods Lecture (9 hrs) Discussion (3 hrs) Outside Assignments (4 hrs) Instructional Environment/Design Classroom (12 hrs) Home Study (4 hrs) Group/Lock Step Instructional Guidance Relate the history of milk and how mankind has depended on this nutritional food for thousands of years. Define "milk", to establish a common framework for future discussion. Discuss the facets of milk processing including sanitary standards for dairy plants and dairy plant equipment. Discuss methods of processing various dairy products.

PLAN OF INSTRUCTION (Continued)

UNITS OF INSTRUCTION AND CRITERION OBJECTIVES 1	DURATION (HOURS) 2	SUPPORT MATERIALS AND GUIDANCE 3
2. Inspection of Dairy Products a. Given appropriate references, perform an inspection of selected dairy products. Satisfactory achievement consists of attaining a score of not less than 70 percent when scored in accordance with checklist 3ABR90830-VIII-2a. b. Given applicable directives, references and standards concerning procurement quality assurance for fresh dairy products and a practical exercise, determine contract compliance in accordance with AFM 74-15. Satisfactory achievement consists of attaining a score of not less than 70 percent when scored in accordance with checklist 3ABR90830-VIII-2b.	17 (13/4) (9/2) (4/2)	Column 1 Reference — STS Reference 2a — 13b 2b — 13d Instructional Materials ST 3ABR90830-VIII-1 WB 3ABR90830-VIII-1 AFM 74-15, Procurement Quality Assurance for Fresh Dairy Products AFR 163-7, Veterinary Food Inspection Procedures for the Inspection of Milk and Milk Products in Bulk Dispenser Containers MIL-STD 175B, Minimum Sanitary Standards for the Equipment and Methods for the Handling of Milk and Milk Products in Bulk Milk Dispensing Operations USPHS, Grade "A" Pasteurized Milk Ordinance Audio Visual Aids Transparencies, Dairy Series 35 mm Slides, Dairy Series 16 mm Film 3-84, Cheese Making in Dairyland (30 min) 16 mm Film - Back the Attack on Brucellosis (26 min) Training Equipment Training Aid (Assorted Dairy Products) (15) Training Methods Lecture (6 hrs) Discussion (2 hrs) Performance (5 hrs) Outside Assignments (4 hrs) Instructional Environment/Design Classroom (8 hrs) Laboratory (1 hr) Laboratory (Dairy Plant) (4 hrs) Home Study (4 hrs) Group/Lock Step

PLAN OF INSTRUCTION (Continued)

1 UNITS OF INSTRUCTION AND CRITERION OBJECTIVES	2 DURATION (HOURS)	3 SUPPORT MATERIALS AND GUIDANCE
		Instructional Guidance Utilizing 16 mm films and overhead transparencies, introduce the objectives of dairy products inspection. Elaborate on the composition and properties of milk. Discuss the public health aspects of milk-borne diseases. Under the guidance of one instructor per 10 students, visit a modern dairy plant. The purpose of this trip is to reinforce previous lecture materials concerning fluid milk processing and dairy products manufacturing. Utilizing AFM 74-15, explain the procurement quality assurance program for fresh dairy products and have students complete a practical exercise on same.
3. Related Training (Identified in the Course Chart)	2	
4. Measurement Test and Test Critique	2	

PLAN OF INSTRUCTION	COURSE TITLE Veterinary Specialist

BLOCK TITLE
Miscellaneous Foods

UNITS OF INSTRUCTION AND CRITERION OBJECTIVES 1	DURATION (HOURS) 2	SUPPORT MATERIALS AND GUIDANCE 3
1. Inspection of Fish and Shellfish a. Identify the appropriate standards for inspection of commercial seafood establishments. b. Given pertinent inspection documents and standards and samples of fish or shellfish, determine the quality, wholesomeness and contract compliance of the waterfood samples. Satisfactory achievement consists of attaining a score of not less than 70 percent when scored according to checklist 3ABR90830-IX-1b.	14 (11/3) (6/2) (5/1)	Column 1 Reference 1a — STS Reference 12b 1b — 12a Instructional Materials ST 3ABR90830-IX-1, Inspection of Waterfoods WB 3ABR90830-IX-1, Inspection of Waterfoods FED SPEC PP-F-381, Fish, Chilled and Frozen USPHS, Interstate Certified Shellfish Shippers List Audio Visual Aids Transparencies, Waterfood Series 35mm Slides, Waterfood Series 16mm Film, Salmon, Catch to Can (18 Min) 16mm Film - FLC 16-85, Oyster Production and Processing (20 Min) Training Equipment Training Aid, (Fish and Shellfish Samples) (15) Taylor Color Comparitor (1) Fillet Candler (15) pHydrion Papers (1) Training Methods Lecture (9 hrs) Outside Assignments (3 hrs) Instructional Environment/Design Classroom (9 hrs) Laboratory (2 hrs) Home Study (3 hrs) Group/Lock Step

PLAN OF INSTRUCTION (Continued)

UN[illegible] LESSON OBJECTIVES 1	DURATION (HOURS) 2	SUPPORT MATERIALS AND GUIDANCE 3
		Instructional Guidance Relate the elementary anatomy and physiology of various categories of waterfoods to inspection criteria. Identify species and physiological characteristics that influence condition, quality, and environmental spoilage factors. Have students complete a workbook exercise pertaining to quality, wholesomeness, and contract compliance determination.
2. Inspection of Fruits and Vegetables	14 (11/3)	Column 1 Reference — STS Reference 2a — 17a 2b — 17b, 17c 2c — 17b
a. Identify anatomical and physiological features of fruits and vegetables.	(1)	
b. Given applicable inspection documents, references and standards and samples of various fresh fruits and vegetables, determine contract compliance and recommend proper disposition. Satisfactory achievement consists of attaining a score of not less than 70 percent when scored according to checklist 3ABR90830-IX-2b.	(6/1)	**Instructional Materials** ST 3ABR90830-IX-2, Fruit and Vegetable Inspection WB 3ABR90830-IX-2, Fruit and Vegetable Inspection SW 3ABR90830-IX-2, Fruit and Vegetable Inspection Federal Specification, HHH-V-1744 Gen, Vegetables, Fresh Applicable Grade Standards Moyer, "Blue Goose" Buying Guide
c. Given necessary references and narrative descriptions of common storage practices at Air Force installations, identify improper practices and recommend appropriate corrective measures. Satisfactory completion consists of attaining a score of not less than 70 percent when scored according to checklist 3ABR90830-IX-2c.	(4/2)	**Audio Visual Aids** Transparencies, Fruit and Vegetable Series 35 mm Slides, Fruit and Vegetable Series 16 mm Film - TF 6368, USAF Veterinary Support on Taiwan for SEA (20 Min) 16 mm Film - FLC 6-143, Fresh From the West (22 Min) Audio Visual Program, Maintaining Freshness of Fruits and Vegetables 16 mm Film - FLC 6-144, Fruits of a Lifetime (26 min)
		Training Equipment Training Aids, (Assorted Fruit and Vegetable Samples) (15)
		Training Methods Lecture (6 hrs) Performance (5 hrs) Outside Assignments (3 hrs)

PLAN OF IN[illegible]	DATE	BLOCK NO	PAGE NO
3ABR90830	11 JUL 1975	IX	33

PLAN OF INSTRUCTION (Continued)

UNITS OF INSTRUCTION AND CRITERION OBJECTIVES 1	DURATION (HOURS) 2	SUPPORT MATERIALS AND GUIDANCE 3
		Instructional Environment/Design Classroom (6 hrs) Laboratory (5 hrs) Home Study (3 hrs) Group/Lock Step Instructional Guidance Relate botanical terms, anatomical structures and physiological processes of fruits and vegetables to veterinary inspection criteria. Emphasize storage conditions as they affect condition and quality. Visit the commissary sales store to observe actual inspection procedures. Conduct practical exercises concerning inspection procedures, determining contract compliance, evaluating storage practices, and recommending proper disposition of fruits and vegetables.
3. Measurement Test and Test Critique	2	

PLAN OF INSTRUCTION

COURSE TITLE
Veterinary Specialist

BLOCK TITLE
Food Technology and Military Operational Rations

UNITS OF INSTRUCTION AND CRITERION OBJECTIVES 1	DURATION (HOURS) 2	SUPPORT MATERIALS AND GUIDANCE 3
1. Principles of Food Preservation a. Identify the more common methods of food preservation.	13 (9/4)	Column 1 Reference 1a — STS Reference 11a Instructional Materials ST 3ABR90830-X-1, Food Technology SW 3ABR90830-X-1, Food Preservation Audio Visual Aids Transparencies, Food Technology Series Training Equipment Training Aids, (Assorted Preserved Foods) (15) Training Methods Lecture (5 hrs) Demonstration (4 hrs) Outside Assignments (4 hrs) Instructional Environment/Design Classroom (5 hrs) Laboratory (4 hrs) Home Study (4 hrs) Group/Lock Step Instructional Guidance Begin the unit with a discussion of the basic causes of food spoilage and quality deterioration. Relate these to the basic principles of food preservation. Describe the generally-used methods of food preservation including drying, refrigeration/freezing, thermal preservation, chemical additives and fermentation. Describe/discuss peculiarities of foods preserved by each of these methods and how the preservation processes relate to subsequent storage requirements. Have students complete workbook exercises as outside study assignments.

PLAN OF INSTRUCTION NO. 3ABR90830	DATE 11 JUL 1978	BLOCK NO. X	PAGE NO. 35

PLAN OF INSTRUCTION (Continued)

UNITS OF INSTRUCTION AND CRITERION OBJECTIVES 1	DURATION (HOURS) 2	SUPPORT MATERIALS AND GUIDANCE 3
2. Inspection and Storage of Preserved Foods a. Identify common food storage procedures. b. Given applicable references, directives and forms, and samples of a variety of preserved foods; determine condition of the product (including compliance with packaging, packing and marking requirements) and recommend appropriate disposition. Satisfactory achievement consists of attaining a score of not less than 70 percent when scored according to checklist 3ABR90830-X-2a.	5 (3/2)	Column 1 Reference STS Reference 2a 11a 2b 11b, 11c Instructional Materials ST 3ABR90830-X-1 AFM 145-1, Commissary and Subsistence Depot Operating Manual Audio Visual Aids Transparencies, Food Technology Series Training Equipment Training Aids, (Assorted Preserved Foods) (15) Training Methods Lecture (2 hrs) Performance (1 hr) Outside Assignments (2 hrs) Instructional Environment/Design Classroom (2 hrs) Laboratory (Cold and Dry Storage Facilities)(1 hr) Home Study (2 hrs) Group/Lock Step Instructional Guidance Relate the importance of proper handling and storing of preserved and fresh foods and the consequences of improper storage procedures . Describe proper storage techniques including the effect of various types of packaging and packing materials on potential shelf life of preserved foods. Visit base cold storage and dry storage facilities to allow students observation of in-use practices and to reinforce information presented in the classroom. Have students complete a practical exercise pertaining to the inspection of preserved foods, including appropriate recommendations for their storage and/or disposal.
3. Military Operational Rations	8 (6/2)	Column 1 Reference STS Reference 3a 11d

PLAN OF INSTRUCTION (Continued)

UNITS OF INSTRUCTION AND CRITERION OBJECTIVES 1	DURATION (HOURS) 2	SUPPORT MATERIALS AND GUIDANCE 3
a. Provided with samples of current operational rations, and appropriate references and documents, inspect military operational rations. Satisfactory achievement consists of attaining a score of not less than 70 percent accuracy when scored in accordance with checklist 3ABR90830-X-3a.		Instructional Materials ST 3ABR90830-X-1 SW 3ABR90830-X-3, Ration Inspection AFM 163-3, Veterinary Inspection Procedures for Operational Rations and Other Non-Perishable Subsistence US Army Natick Laboratories, Operational Rations, Current and Future of the Department of Defense MIL-STD 105D, Sampling Procedures and Tables for Inspection by Attributes AFSO - Handbook, Consumer Level Quality Audit Program AF Form 2063, Individual COLEQUAP Report Audio Visual Aids Transparencies, Ration Series Training Equipment Training Aids, (Assorted Operational Ration Samples)(15) Training Methods Lecture (0.5 hrs) Discussion (0.5 hrs) Demonstration (2 hrs) Performance (3 hrs) Outside Assignments (2 hrs) Instructional Environment/Design Classroom (3 hrs) Laboratory (3 hrs) Home Study (2 hrs) Group/Lock Step Instructional Guidance Utilizing overhead transparencies and AFM 163-3, discuss the types of operational rations and their intended use. Discuss deteriorative changes that occur and how to avoid these changes. Use samples of various rations to demonstrate their characteristics. Show step-by-step procedures to be followed in conducting inspections of operational rations and then have students complete a practical exercise.
4. Measurement Test and Test Critique	2	

PLAN OF INSTRUCTION NO. 3ABR90830	DATE 11 JUL 1975	BLOCK NO. X	PAGE NO. 37

PLAN OF INSTRUCTION	COURSE TITLE Veterinary Specialist	
BLOCK TITLE Animal Service and Zoonoses Control Activities		
UNITS OF INSTRUCTION AND CRITERION OBJECTIVES	DURATION (HOURS) 2	SUPPORT MATERIALS AND GUIDANCE 3
1. Veterinary Responsibilities for Animal Service a. Identify the responsibilities of the Veterinary Service for zoonoses control and care of private and government-owned animals.	2	Column 1 Reference 1a STS Reference 19a, 19b Instructional Materials ST 3ABR90830-XI-1, Animal Service Audio Visual Aids Transparencies, Animal Service Series Training Methods Lecture (2 hrs) Instructional Environment/Design Classroom (2 hrs) Group/Lock Step Instructional Guidance Discuss the mission of the Veterinary Service in regard to both government owned and privately owned animals. Include the scope of services provided for each and the directives which apply.
2. Government Owned Animals a. Identify activities of the Veterinary Service in support of government-owned animals (including preparation of reports and maintaining records and supplies).	5 (3/2)	Column 1 Reference 2a STS Reference 19b, 19e Instructional Materials ST 3ABR90830-XI-1 Audio Visual Aids Transparencies, Animal Service Series 16mm Film - TF 6362, Dogs of the Air Force, Patrol Dogs (25 Min)
PLAN OF INSTRUCTION NUMBER 3ABR90830	DATE 11 JUL 1975	X

37

2

PLAN OF INSTRUCTION (Continued)

UNITS OF INSTRUCTION AND CRITERION OBJECTIVES 1	DURATION (HOURS) 2	SUPPORT MATERIALS AND GUIDANCE 3
		35 mm Slides, Military Working Dog Series **Training Methods** Lecture (2 hrs) Performance (1 hr) Outside Assignments (2 hrs) **Instructional Environment/Design** Classroom (2 hrs) Laboratory (1 hr) Home Study (2 hrs) Group/Lock Step **Instructional Guidance** Discuss the various aspects of the military working dog program including utilization, capabilities, procurement, and veterinary support. Explain the mission and organization of the Veterinary Service in regards to research support. Have students complete a practical exercise pertaining to veterinary support of government-owned animals. If available, a guest lecturer will be used to discuss the role of the veterinary service in and in support of research activities.
3. Subprofessional Clinical Procedures a. Recognize the responsibilities and limitations in providing subprofessional clinical advice and assistance in the handling, care, and treatment of animals.	10 (8/2)	**Column 1 Reference** 3a — **STS Reference** 19a, 19c **Instructional Materials** ST 3ABR90830-XI-1 **Audio Visual Aids** 35 mm Slides, Animal Service Series Transparencies, Animal Service Series 16 mm Film - TF 6073, Dogs of the Air Force--Care-First Aid (25 min) 16 mm Film - FTA 228, Parenteral Medication of Sentry Dogs (14 min) **Training Equipment** Training Aids (Dog Skeleton)(15) Restraint Devices (15)

PLAN OF INSTRUCTION (Continued)

UNITS OF INSTRUCTION AND CRITERION OBJECTIVES 1	DURATION (HOURS) 2	SUPPORT MATERIALS AND GUIDANCE 3
		Radiographic Viewer (15) Assorted Surgical Instruments (15) Assorted Syringes and Needles (15) Training Methods Lecture (5 hrs) Demonstration (3 hrs) Outside Assignments (2 hrs) Instructional Environment/Design Classroom (8 hrs) Home Study (2 hrs) Group/Lock Step Instructional Guidance Use available training aids (skeletons, etc.) to assist in locating salient anatomical features. Discuss the relationship of various landmarks to certain clinical procedures. Discuss methods used for anesthesia and describe stages of anesthesia. Discuss methods of restraint and means of administering various types of medications. Have students complete a practical exercise pertaining to subprofessional clinical support procedures as an outside assignment.
4. Clinic Management a. Given necessary directives, information and forms, correctly identify the techniques and procedures required to provide effective management and operation of a zoonoses control clinic. Satisfactory achievement consists of attaining a score of not less than 70 percent accuracy when scored in accordance with checklist 3ABR90830-XI-4a.	5 (3/2)	Column 1 Reference 4a STS Reference 19a, 19d, 19e Instructional Materials ST 3ABR90830-XI-1 ✓ AFR 161-4, Medical and Agricultural Foreign and Domestic Quarantine Regulations for Vessels, Aircraft, and other Transport of the Armed Forces ✓ AFR 163-4, Prevention and Control of Communicable Diseases of Animals ✓ AFR 163-11, Veterinary Service, USAF ✓ SW 3ABR90830-XI-4, Clinic Management Audio Visual Aids Transparencies, Animal Service Series Training Methods Lecture (2 hrs)

PLAN OF INSTRUCTION (Continued)

UNITS OF INSTRUCTION AND CRITERION OBJECTIVES 1	DURATION (HOURS) 2	SUPPORT MATERIALS AND GUIDANCE 3
		Performance (1 hr) Outside Assignments (2 hrs) **Instructional Environment/Design** Classroom (2 hrs) Laboratory (1 hr) Home Study (2 hrs) Group/Lock Step **Instructional Guidance** Describe various forms used in the zoonoses control program. Discuss various management techniques in order to establish an efficiently operated clinic. Discuss relationship with patrons of the zoonoses control clinic. Describe procedures for procurement of medical supplies in support of the clinic. Have students complete a practical exercise pertaining to clinic management.
5. **Identification and Control of Communicable/Zoonotic Diseases** a. Given necessary information, current publications, directives, laboratory equipment, and fecal specimens, use proper laboratory techniques to identify certain causative agents of communicable/zoonotic diseases. Satisfactory achievement is accomplished by attaining a score of not less than 70 percent when scored according to a checklist 3ABR90830-XI-5a.	18 (16/2)	**Column 1 Reference** 5a **STS Reference** 5a, 5b, 10b, 19f **Instructional Materials** ST 3ABR90830-XI-1 SW 3ABR90830-XI-5, Parasitology **Audio Visual Aids** Transparencies, Animal Service Series 16 mm Film - TF 1-8054, Ascariasis (17 Min) 16 mm Film - TF 6076, Sentry Dogs Disease Prevention (25 min) 16 mm Film - FLC 12-37, Leptospirosis (13 Min) 16 mm Film - FLC 20-60, Tick and Tick-Borne Diseases (24 Min) 16 mm Film - FLC 1-187, Animal Bites and Rabies (16 Min) 16 mm Film - FLC 4-0096, Dirofilaria Immitis, Development and Transmission (16 Min) Audio Visual Slide/Sound Program - Parasitology

PLAN OF INSTRUCTION (Continued)

1 UNITS OF INSTRUCTION AND CRITERION OBJECTIVES	2 DURATION (HOURS)	3 SUPPORT MATERIALS AND GUIDANCE
		Training Equipment Microscopes (1) Fecalizers (1) Parasite-Preserved Specimen (1) Prepared Microscopic Slides (1) Training Methods Lecture (10 hrs) Demonstration (2 hrs) Performance (4 hrs) Outside Assignments (2 hrs) Instructional Environment/Design Classroom (12 hrs) Laboratory (4 hrs) Home Study (2 hrs) Group/Lock Step Instructional Guidance Discuss the important factors in the identification, occurrence, mode(s) of transmission, symptomatology, therapy, and control methods of the more common communicable and non-communicable diseases of animals and of the more common zoonoses. Describe basic laboratory procedures used in the identification of common internal and external parasites of animals. Describe the more common internal and external parasites from the standpoints of general characteristics, life cycles, common species infecting both animals and man prevention, and control. Demonstrate procedures for performing fecal examinations for internal parasites and then have students perform same.
6. Related Training (Identified in the Course Chart)	8	
7. Measurement Test and Test Critique	2	

PLAN OF INSTRUCTION (Continued)

1 UNITS OF INSTRUCTION AND CRITERION OBJECTIVES	2 DURATION (HOURS)	3 SUPPORT MATERIALS AND GUIDANCE
8. Course Critique and Graduation	2	Instructional Materials ATC Form 736, Student Critique AF Form 175, HomeTown News Release Data AF Form 1256, Certificate of Training Instructional Guidance Students will turn in all books, complete ATC Form 736, and Hometown News Releases if applicable. Graduation will include recognition of outstanding academic and/or personal achievement, receive instruction concerning travel safety followed by individual presentation of AF Form 1256.

PLAN OF INSTRUCTION NO. 3ABR90830	DATE 11 JUL 1975	BLOCK NO. XII	PAGE NO. 43

COURSE EVALUATION DATA SHEET

DATE 27 FEB 1975

COURSE 3ABR90830, Veterinary Specialist

FUNCTION CODE 552154

MED TECHNICIAN TSgt Jimmy Smith

PERSON(S) DATA COLLECTED FROM Capt Cardin/6668

LENGTH (Days) 57

SHIFT LIMIT 4

CENTER Sheppard AFB TX

PRESENT GROUP SIZE(S) 12/15/8

PROPOSED GROUP SIZE(S) 12/15/8 min

GROUP SIZE JUSTIFICATION

Maximum group size is limited by classroom and laboratory size and the limited space available during the field trips which utilize Base Dining Hall, Cold Storage Warehouse, Commissary, Base Veterinary Office, and several commercial firms.

NOTE: End of block measurement tests are given the first period the day following completion of the block.

Latest POI revision varies with the approved ATC Form 896; however, the total academic instructor hours remain the same.

BLOCK NO. TOTAL HRS	POI VOL	POI VOL DATE	DAY	CLASSROOM INSTRUCTION			MEASUREMENT			INST* REQD	C/L INST HOURS
				L, DS	DM	P	WRITTEN	PERF	COMBN W/P		
I-34			1/1	4.4	1.0	0.6				1	6
			1/2	5.0	1.0					1	6
			1/3	1.0	2.0					1	3
			1/3			3.0				2	6
			1/4	3.0						1	3
			1/4			3.0				2	6
			1/5	4.0	2.0					1	6
			2/6	2.0						1	2
II-32			2/6	2.0	2.0					1	4
			2/7				2.0			1	2
			2/7	1.0						1	1
			2/7			3.0				2	6
			2/8	3.0		3.0				1	6
			2/9	2.0		2.0				1	4
			2/9			2.0				2	4
			2/10	4.0		2.0				1	6

* INCLUDE NARRATIVE JUSTIFICATION FOR ALL MULTIPLE INSTRUCTORS BY DAY AND HOUR ON ATC FORM 896B.

ATC FORM SEP 73 896 PREVIOUS EDITION OBSOLETE. ANNEX-1

43

COURSE EVALUATION DATA CONTINUATION SHEET

BLK NO. TOTAL HRS	POI VOL	POI VOL DATE	DAY	CLASSROOM INSTION L, DS	CLASSROOM INSTION DM	CLASSROOM INSTION P	MEASUREMENT WRITN	MEASUREMENT PERF	MEASUREMENT COMBN W/P	INST* REQD	C/L INST HOURS
II-32			3/11			2.0				2	4
			3/11	4.0						1	4
			3/12				2.0			1	2
III-26			3/12	4.0						1	4
			3/13	4.0						1	4
			3/13			2.0				2	4
			3/14	4.0		2.0				1	6
			3/15	4.0						1	4
			3/15			2.0				2	4
IV-36			4/16	2.0			2.0			1	4
			4/16			2.0				2	4
			4/17	3.0						1	3
			4/17			3.0				2	6
			4/18	3.0		3.0				1	6
			4/19	3.0						1	3
			4/19			3.0				2	6
			4/20	6.0						1	6
			5/21	3.0		3.0				1	6
V-24			5/22	4.0			2.0			1	6
			5/23	3.0						1	3
			5/23			3.0				2	6
			5/24	3.0						1	3
			5/24			3.0				2	6
			5/25			6.0				2	12
VI-48			6/26	4.0			2.0			1	6
			6/27	6.0						1	6

* INCLUDE NARRATIVE JUSTIFICATION FOR ALL MULTIPLE INSTRUCTORS BY DAY AND HOUR ON ATC FORM 896B.

ATC FORM SEP 77 896A PREVIOUS EDITION OBSOLETE ANNEX-2

1

COURSE EVALUATION DATA CONTINUATION SHEET

BLK NO. TOTAL HRS	POI VOL	POI VOL DATE	DAY	CLASSROOM INSTION			MEASUREMENT			INST* REQD	C/L INST HOURS
				L, DS	DM	P	WRITN	PERF	COMBN W/P		
			6/28	3.0						1	3
			6/28			3.0				2	6
			6/29	4.0						1	4
			6/29			2.0				2	4
			6/30	4.0			2.0			1	6
			7/31	4.0	2.0					1	6
			7/32	4.0						1	4
			7/32			2.0				2	4
			7/33	3.0						1	3
			7/33			3.0				2	6
VII-33			7/34	4.0			2.0			1	6
			7/35	1.0						1	1
			7/35			5.0				2	10
			8/36	3.0	3.0					1	6
			8/37	4.0		2.0				1	6
			8/38	3.0		3.0				1	6
VIII-27			8/39	6.0						1	6
			8/40	4.0			2.0			1	6
			9/41	4.0	2.0					1	6
			9/42	3.0						1	3
			9/42			3.0				2	6
			9/43	4.0	2.0					1	6
			9/44	4.0			2.0			1	6
IX-24			9/45	4.0						1	4
			9/45			2.0				2	4
			10/46	4.0		2.0				1	6

* INCLUDE NARRATIVE JUSTIFICATION FOR ALL MULTIPLE INSTRUCTORS BY DAY AND HOUR ON ATC FORM 896B.

ATC FORM SEP 73 896A PREVIOUS EDITION OBSOLETE. ANNEX-3

COURSE EVALUATION DATA CONTINUATION SHEET

BLK NO.	POI VOL	POI VOL DATE	DAY	CLASSROOM INSTION			MEASUREMENT			INST* REQD	C/L INST HOURS
TOTAL HRS				L, DS	DM	P	WRITN	PERF	COMBN W/P		
			10/47	4.0		2.0				1	6
X-20			10/48	4.0			2.0			1	6
			10/49	4.0	2.0					1	6
			10/50	4.0						1	4
			10/50			2.0				2	4
			11/51	6.0						1	6
			11/52	4.0			2.0			1	6
XI-36			11/53	2.0						1	2
			11/53			4.0				2	8
			11/54	4.0	1.0	1.0				1	6
			11/55	4.0	2.0					1	6
			11/56	4.0	1.0	1.0				1	6
			11/57	2.0			2.0			1	4

* INCLUDE NARRATIVE JUSTIFICATION FOR ALL MULTIPLE INSTRUCTORS BY DAY AND HOUR ON ATC FORM 896B.

ATC FORM SEP 77 896A PREVIOUS EDITION OBSOLETE. ANNEX-4

JUSTIFICATION FOR MULTIPLE INSTRUCTOR REQUIREMENTS:

Week 1, Day 3: This is 3 hours of a 6-hour performance project which continues into day 4. Two instructors are required to provide close supervision and to insure timely completion of the project within the time allowed. During these performance hours, students will complete the recording and reporting of an inspection of subsistence utilizing applicable forms, references, and documents. Detailed, step-by-step research and progress must be closely supervised to insure completion within the allotted time.

Week 1, Day 4: These 3 hours are a continuation of day 3 and were explained under day 3.

Week 2, Day 7: Three hours of performance require two instructors provide close supervision and permit project completion in the time allowed. These 3 hours require detailed research in extracting sampling plans and devising sampling patterns

Week 2, Day 9: Two hours of performance are devoted to performing an exercise in verification inspection procedures. Two instructors are required to provide close supervision to insure that technically accurate statistical methods are employed and to insure correct step-by-step progress and timely completion.

Week 3, Day 11: Two hours of performance are devoted to performing a complete COLEQUAP inspection. Two instructors are needed to provide close supervision to insure correct step-by-step progress and timely completion.

Week 3, Day 13: Two hours of performance are devoted to identifying the effects of various environmental factors on the growth of microorganisms in food items. Two instructors are required to provide close supervision and insure students are able to correctly identify causative factors and recommend corrective actions.

Week 3, Day 15: Two hours of performance are devoted to correct usage of the compound microscope. Two instructors are required in order to assist and provide close supervision to insure that correct procedures are employed in utilizing the microscope.

PREVIOUS TOTAL C/L INSTRUCTOR HOURS REQUIRED PER ENTRY GP 451	PROPOSED TOTAL C/L INSTRUCTOR HOURS REQUIRED PER ENTRY GP 403

RECOMMENDATIONS:

ROBERT S. HAUSER, Capt, USAF, MSC
Chief, Resource Management Division

HOWARD W. FRANK, Major, USAF
Commander
Management Engineering Det 5

Week 4, Day 16: Two hours of performance are devoted to correct procedures for inspecting a food service facility. The class is divided into two groups with an instructor for each group. The instructor will demonstrate the correct procedures for inspecting a food service facility.

Week 4, Day 17: Three hours of performance are devoted to a field trip to a food service facility for the purpose of medical evaluation. One instructor per eight students must be utilized to insure complete evaluation and adequate span of control.

Week 4, Day 19: Three hours of performance are devoted to a field trip to a food service facility for the purpose of medical evaluation. One instructor per six students must be utilized to insure complete evaluation and adequate span of control.

Week 5, Day 23: Three hours of performance are devoted to a laboratory inspection of dairy products. The class is divided into two groups, with one instructor per group, to permit the proper inspection of these dairy products.

Week 5, Day 24: Three hours of performance are devoted to preparation and use of EMB plates to evaluate personal hygienic practices of food handlers. Two instructors are required to supervise students as they prepare the plates, utilize them to evaluate personal hygiene of selected personnel and evaluate the results.

Week 5, Day 25: Six hours of laboratory performance require two instructors to properly supervise the laboratory procedures to determine acceptability and contract compliance of selected food items. Swab tests, rinse tests, and finger plate culture tests also require two instructors to insure proper laboratory techniques are observed.

Week 6, Day 28: These 3 hours of performance are a field trip to an off-base commercial meat packing plant. The class must be divided into two groups to permit students to properly observe packing plant operations and to insure minimal disruption of the plant operation. One instructor is required with each group to provide proper supervision and comply with all safety precautions.

Week 6, Day 29: These 2 hours of performance are devoted to laboratory analyses for fat content in meat products. Students use cooking utensils and the Hobart fat tester. Two instructors are required to provide close supervision and insure timely project completion.

Week 7, Day 32: These 2 hours of performance provide a laboratory project for inspection and evaluation of a designated COLEQUAP meat item. Two instructors are required to insure timely completion of the project by providing on-the-spot correction and guidance.

Week 7, Day 33: Two instructors are required during these 3 hours of performance as the class is divided into two groups. These 3 hours are conducted in the Base Cold Storage Warehouse and provide for inspection of meat in that facility.

Week 7, Day 35: These 5 hours of laboratory performance deal with candling and grading of shell eggs. Two instructors are required to insure proper egg candling techniques and timely completion of this project.

Week 9, Day 42: Three hours of performance require two instructors. It is necessary to divide the class into two groups as these 3 hours are a field trip to a commercial dairy plant and close observation of dairy operations is not possible with large groups proceeding together in the facility. One large group would interfere with the operations of the privately owned dairy and course objectives could not be met.

Week 9, Day 45: These 2 hours of performance involve determining the quality, wholesomeness, and contract compliance of waterfood samples. Two instructors are required to insure that correct procedures are utilized and to provide assistance in interpreting specifications.

Week 10, Day 50: These 2 hours are a field trip to the commissary sales store to observe actual inspection procedures. Two instructors are required to maintain proper span of control to eliminate disruption of normal commissary activities.

Week 11, Day 53: These 4 hours require two instructors to properly supervise student performance during use of compound microscopes during laboratory analyses of specimens for internal and external parasites of animals.

49

LESSON PLAN (Part I, General)

APPROVAL OFFICE AND DATE MSDV/Britz Britz 3 NOV 1975	INSTRUCTOR
COURSE NUMBER 3ABR90830	COURSE TITLE Veterinary Specialist
BLOCK NUMBER VII	BLOCK TITLE Poultry and Egg Inspection

LESSON TITLE
Inspection of Poultry and Poultry Products

LESSON DURATION

CLASSROOM /Laboratory	Complementary	TOTAL
6 hrs	None	6 hrs

POI REFERENCE

PAGE NUMBER	PAGE DATE	PARAGRAPH
25	11 Jul 75	1a, 1b

STS/CTS REFERENCE

NUMBER	DATE
STS908X0	25 March 75

SUPERVISOR APPROVAL

SIGNATURE	DATE	SIGNATURE	DATE
William E Britz Jr.	3 NOV 1975		

PRECLASS PREPARATION

EQUIPMENT LOCATED IN LABORATORY	EQUIPMENT FROM SUPPLY	CLASSIFIED MATERIAL	GRAPHIC AIDS AND UNCLASSIFIED MATERIAL
Poultry skeleton (15) Poultry samples (15)	None	None	See attached sheet

CRITERION OBJECTIVES AND TEACHING STEPS

1a. Identify the appropriate standards for performing sanitary inspection of poultry processing facilities.

1b. Given applicable references, documents, and standards, verify grade and condition of selected poultry samples. Satisfactory achievement consists of attaining a score of not less than 70 percent when scored according to Checklist 3ABR90830-VII-1b.

(Teaching steps listed in Part II)

1-4

TC FORM AUG 72 770

77

Graphic Aids and Unclassified Material Cont'd.

ST 3ABR90830-VII-1, Poultry Inspection
FED-SPEC: PP-C-248, Chickens, Chilled and Frozen (Ready-To-Cook)
USDA, Poultry Grading Manual
Transparencies, Poultry Series
16mm Film - TF 1-8151, Poultry Processing Inspection (18 min)
35mm Slides, Poultry Series

51

APPROVAL OFFICE AND DATE MSDV/Britz Britz 3 NOV 1975	INSTRUCTOR
COURSE NUMBER 3ABR90830	COURSE TITLE Veterinary Specialist
BLOCK NUMBER III	BLOCK TITLE Poultry and Egg Inspection

LESSON TITLE
Egg Formation and Egg Production/Processing Facilities

LESSON DURATION

CLASSROOM/~~Laboratory~~ 3 hrs	~~XXXXXXXXX~~ Complementary 1 hr	TOTAL 4 hrs

POI REFERENCE

PAGE NUMBER 26	PAGE DATE 11 Jul 75	PARAGRAPH 2a, 2b

STS/CTS REFERENCE

NUMBER STS908X0	DATE 25 March 75

SUPERVISOR APPROVAL

SIGNATURE	DATE	SIGNATURE	DATE
William E Britz Jr	3 NOV 1975		

PRECLASS PREPARATION

EQUIPMENT LOCATED IN LABORATORY	EQUIPMENT FROM SUPPLY	CLASSIFIED MATERIAL	GRAPHIC AIDS AND UNCLASSIFIED MATERIAL
None	None	None	See attached sheet

CRITERION OBJECTIVES AND TEACHING STEPS

2a. Identify the anatomy and physiology of the avian reproductive tract, egg formation, and egg structures.

2b. Identify the appropriate standards for sanitary inspection of egg producing and processing facilities.

(Teaching steps listed in Part II)

1-4

C FORM AUG 73 770

52

raphic Aids and Unclassified Material Cont'd.

ransparencies, Shell Egg Series
5mm Slides, Shell Egg Series
6mm Film TFA 427, Fundamentals of Egg Candling (8 min)
T 3ABR90830-VII-2
F 3ABR90830-VII-3, Egg Inspection
PSC Manual 4155.6, Subsistence Inspection Manual
hell Egg Grading Percentage Tables
D Form 1237, Report of Inspection of Shell Eggs

53

APPROVAL OFFICE AND DATE MSDV/Britz 3 NOV 1975	INSTRUCTOR
COURSE NUMBER 3ABR90830	COURSE TITLE Veterinary Specialist
BLOCK NUMBER VII	BLOCK TITLE Poultry and Egg Inspection

LESSON TITLE
Egg Quality Determination

LESSON DURATION

CLASSROOM/Laboratory 8 hrs	xxxxxxxxx Complementary 4 hrs	TOTAL 12 hrs

POI REFERENCE

PAGE NUMBER 26 & 27	PAGE DATE 11 Jul 75	PARAGRAPH 3a

STS/CTS REFERENCE

NUMBER STS908X0	DATE 25 March 75

SUPERVISOR APPROVAL

SIGNATURE	DATE	SIGNATURE	DATE
William E Britz Jr	3 NOV 1975		

PRECLASS PREPARATION

EQUIPMENT LOCATED IN LABORATORY	EQUIPMENT FROM SUPPLY	CLASSIFIED MATERIAL	GRAPHIC AIDS AND UNCLASSIFIED MATERIAL
Egg inspection laboratory (15) Egg inspection kit (1) Egg air cell measuring gauges (1)	1 case of Procurement I eggs	None	See attached sheet

CRITERION OBJECTIVES AND TEACHING STEPS

3a. Given necessary equipment, forms, references, standards and simulated exercises, determine the quality of a sample of eggs and complete the required inspection reports. Satisfactory achievement consists of attaining a score of not less than 70 percent when scored according to checklist 3ABR90830-VII-3a.

(Teaching steps listed in Part II)

1-4

ATC FORM AUG 72 770

[illegible] Aids and Unclassified Materials Cont'd.

[illegible]rencies. Contract Compliance and Surveillance Inspection Series
[illegible]830-VII-2
DPSC Manual 4155.6, Subsistence Inspection Manual
Shell Egg Graders Percentage Tables
DD Form 1237, Report of Inspection of Shell Eggs

55

LESSON PLAN (Part I, General)

APPROVAL OFFICE AND DATE MSDV/Dritz Brtz 3 NOV 1975	INSTRUCTOR
COURSE NUMBER 3ABR90830	COURSE TITLE Veterinary Specialist
BLOCK NUMBER III	BLOCK TITLE Dairy and Dairy Products

LESSON TITLE
Inspection of Dairy Processing Facilities

LESSON DURATION

CLASSROOM 7Laboratory 12 hrs	Complementary 4 hrs	TOTAL 16 hrs

POI REFERENCE

PAGE NUMBER 29	PAGE DATE 11 Jul 75	PARAGRAPH 1a

STS/CTS REFERENCE

NUMBER STS908X0	DATE 25 March 75

SUPERVISOR APPROVAL

SIGNATURE	DATE	SIGNATURE	DATE
William E Britz Jr	3 NOV 1975		

PRECLASS PREPARATION

EQUIPMENT LOCATED IN LABORATORY	EQUIPMENT FROM SUPPLY	CLASSIFIED MATERIAL	GRAPHIC AIDS AND UNCLASSIFIED MATERIAL
None	None	None	See attached sheet

CRITERION OBJECTIVES AND TEACHING STEPS

1a. Identify appropriate standards for inspection of dairy processing facilities.

(Teaching steps listed in Part II)

1-4

C FORM AUG 72 770

Graphic Aids and Unclassified Materials Cont'd.

ST 3ABR90830-VII-1, Dairy Products Inspection
MIL-STD 668B, Minimum Sanitary Standards for Food Plants
Transparencies, Dairy Series
35mm Slides, Dairy Series
16mm Film - FLC 13-136, Milk and Public Health (10 min)
WB 3ABR90830-VIII-1, Dairy Products
Student Handout 3ABR90830-VIII-1, High Temperature, Short-Time Pasteurizer

57

LESSON PLAN (Part I, General)

AND DATE USDV/Britz Britz 3 NOV 1975	INSTRUCTOR
NUMBER ABR90830	COURSE TITLE Veterinary Specialist
NUMBER VIII	BLOCK TITLE Dairy and Dairy Products

LESSON TITLE
Inspection of Dairy Products

LESSON DURATION

CLASSROOM/Laboratory 13 hrs	~~xxxxxxxxx~~ Complementary 4 hrs	TOTAL 17 hrs

POI REFERENCE

PAGE NUMBER 30	PAGE DATE 11 Jul 75	PARAGRAPH 2a, 2b

STS/CTS REFERENCE

NUMBER STS908X0	DATE 25 March 75

SUPERVISOR APPROVAL

SIGNATURE	DATE	SIGNATURE	DATE
William E Britz Jr	3 NOV 1975		

PRECLASS PREPARATION

EQUIPMENT LOCATED IN LABORATORY	EQUIPMENT FROM SUPPLY	CLASSIFIED MATERIAL	GRAPHIC AIDS AND UNCLASSIFIED MATERIAL
None	Assorted dairy products (15)	None	See attached sheet

CRITERION OBJECTIVES AND TEACHING STEPS

2a. Given appropriate references, perform an inspection of selected dairy products. Satisfactory achievement consists of attaining a score of not less than 70 percent when scored in accordance with checklist 3ABR90830-VIII-2a.

2b. Given applicable directives, references, and standards concerning procurement quality assurance for fresh dairy products and a practical exercise, determine contract compliance in accordance with AFM 74-15. Satisfactory achievement consists of attaining a score of not less than 70 percent when scored in accordance with checklist 3ABR90830-VIII-2b.

(Teaching steps listed in Part II)

1-4

FORM 770

Graphic Aids and Unclassified Material Cont'd.

ST 3ABR90830-VIII-1
WB 3ABR90830-VIII-1
AFM 74-15, Procurement Quality Assurance for Fresh Dairy Products
AFP 163-7, Veterinary Food Inspection Procedures for the Inspection of Milk and Milk Products in Bulk Dispenser Containers
MIL-STD-175B, Minimum Sanitary Standards for the Equipment and Methods for the Handling of Milk and Milk Products in Bulk Milk Dispensing Operations
USPHS, Grade "A" Pasteurized Milk Ordinance
Transparencies, Dairy Series
35mm Slides, Dairy Series
16mm Film, Back the Attack on Brucellosis (26 min)
16mm Film - FLC 3-84, Cheese Making in Dairy Land (30 min)

59

APPROVAL OFFICE AND DATE MSDV/Britz Britz 3 NOV 1975	INSTRUCTOR
COURSE NUMBER 3ABR90830	COURSE TITLE Veterinary Specialist
BLOCK NUMBER	BLOCK TITLE Miscellaneous Foods

LESSON TITLE
Inspection of Fish and Shellfish

LESSON DURATION		
CLASSROOM /Laboratory 11 hrs	~~LABORATORY~~ Complementary 3 hrs	TOTAL 14 hrs

POI REFERENCE		
PAGE NUMBER 32	PAGE DATE 11 Jul 75	PARAGRAPH 1a, 1b

STS/CTS REFERENCE	
NUMBER STS908X0	DATE 25 March 75

SUPERVISOR APPROVAL

SIGNATURE	DATE	SIGNATURE	DATE
William E Britz	3 NOV 1975		

PRECLASS PREPARATION

EQUIPMENT LOCATED IN LABORATORY	EQUIPMENT FROM SUPPLY	CLASSIFIED MATERIAL	GRAPHIC AIDS AND UNCLASSIFIED MATERIAL
Training aid (Fish & Shellfish) (15) Taylor Color Comparitor (1) Fillet candler (15) Phydrion papers (1)	None	None	See attached sheet

CRITERION OBJECTIVES AND TEACHING STEPS

1a. Identify the appropriate standards for inspection of commercial seafood establishments.

1b. Given pertinent inspection documents and standards and samples of fish or shellfish, determine the quality, wholesomeness and contract compliance of the waterfood samples. Satisfactory achievement consists of attaining a score of not less than 70 percent when scored according to checklist 3ABR90830-IX-1b.

(Teaching steps listed in Part II)

1-4

FORM AUG 73 770

hic Aids and Unclassified Material Cont'd.

ansparencies, Waterfoods Series
m Slides, Waterfood Series
m Film, Salmon, Catch to Can (13 min)
m Film, - FLC 16-35, Oyster Production and Processing (20 min)
3AS 90830-IX-1, Inspection of Waterfoods
3ABR90830-IX-1, Inspection of Waterfoods
D Spec PP-F-381, Fish, Chilled and Frozen
PHS, Interstate Certified Shellfish Shippers List

61

LESSON PLAN (Part I, General)

APPROVAL OFFICE AND DATE MSDV/Britz 3 NOV 1975	INSTRUCTOR
COURSE NUMBER 3ABR90830	COURSE TITLE Veterinary Specialist
BLOCK NUMBER	BLOCK TITLE Miscellaneous Foods

LESSON TITLE
Inspection of Fruits and Vegetables

LESSON DURATION

CLASSROOM/Laboratory	Complementary	TOTAL
11 hrs	3 hrs	14 hrs

POI REFERENCE

PAGE NUMBER	PAGE DATE	PARAGRAPH
33	11 Jul 75	2a, 2b, 2c

STS/CTS REFERENCE

NUMBER	DATE
STS908X0	25 March 1975

SUPERVISOR APPROVAL

SIGNATURE	DATE	SIGNATURE	DATE
William E Britz Jr	3 NOV 1975		

PRECLASS PREPARATION

EQUIPMENT LOCATED IN LABORATORY	EQUIPMENT FROM SUPPLY	CLASSIFIED MATERIAL	GRAPHIC AIDS AND UNCLASSIFIED MATERIAL
Training aid (Fruits & Vegetables) (15)	None	None	See attached sheet

CRITERION OBJECTIVES AND TEACHING STEPS

2a. Identify anatomical and physiological features of fruits and vegetables.

2b. Given applicable inspection documents, references and standards and samples of various fresh fruits and vegetables, determine contract compliance and recommend proper disposition. Satisfactory achievement consists of attaining a score of not less than 70 percent when scored according to checklist 3ABR90830-IX-2b.

2c. Given necessary references and narrative descriptions of common storage practices at Air Force installations, identify improper practices and recommend appropriate corrective measures. Satisfactory completion consists of attaining a score of not less than 70 percent when scored according to checklist 3ABR90830-IX-2c.

(Teaching steps listed in Part II)

1-4

FORM 770
AUG

Graphic Aids and Unclassified Material Con't

Transparencies, Fruit and Vegetable Series
35mm Slides, Fruit and Vegetable Series
16mm Film - TF 6368, USAF Veterinary Support for SEA (20 min)
16mm Film - FLC 6-143, Fresh From the West (23 min)
ST 3ABR90830-IX-2, Fruit and Vegetable Inspection
WB 3ABR90830-IX-2, Fruit and Vegetable Inspection
SW 3ABR90830-IX-2, Fruit and Vegetable Inspection
Federal Specification, HHH-U-1744 Gen, Vegetables, Fresh
Applicable Grade Standards
Mover, "Blue Goose" Buying Guide
16mm Film - FLC 6-144, Fruits of a Life Time (26 min)
Audiovisual Program, Fruit and Vegetable Inspection

63

LESSON PLAN (Part I, General)

APPROVAL OFFICE AND DATE DV/Britz Britz 3 NOV 1975	INSTRUCTOR
COURSE NUMBER 3AAR90830	COURSE TITLE Veterinary Specialist
BLOCK NUMBER	BLOCK TITLE Food Technology and Military Operational Rations

LESSON TITLE
rinciples of Food Preservation

LESSON DURATION

CLASSROOM/Laboratory	Complementary	TOTAL
9 hrs	4 hrs	13 hrs

POI REFERENCE

PAGE NUMBER	PAGE DATE	PARAGRAPH
35	11 Jul 75	1a

STS/CTS REFERENCE

NUMBER	DATE
STS908X0	25 March 75

SUPERVISOR APPROVAL

SIGNATURE	DATE	SIGNATURE	DATE
William E Britz Jr	3 NOV 1975		

PRECLASS PREPARATION

EQUIPMENT LOCATED IN LABORATORY	EQUIPMENT FROM SUPPLY	CLASSIFIED MATERIAL	GRAPHIC AIDS AND UNCLASSIFIED MATERIAL
Training aids (Assorted preserved foods) (15)	None	None	See attached sheet

CRITERION OBJECTIVES AND TEACHING STEPS

1a. Identify the more common methods of food preservation.

(Teaching steps listed in Part II)

ATC FORM 770

Graphic Aids and Unclassified Material Cont'd.

Transparencies, Food Technology Series
ST 3ABR90830-X-1, Food Technology
SW 3ABR90830-X-1, Food Preservation

65

LESSON PLAN (Part I, General)

APPROVAL OFFICE AND DATE MSDV/Britz Britz 3 NOV 1975	INSTRUCTOR
COURSE NUMBER 3ABR90830	COURSE TITLE Veterinary Specialist
BLOCK NUMBER V	BLOCK TITLE Food Technology and Military Operational Rations

LESSON TITLE
Inspection and Storage of Preserved Foods

LESSON DURATION

CLASSROOM /Laboratory 3 hrs	Complementary 2 hrs	TOTAL 5 hrs

POI REFERENCE

PAGE NUMBER 36	PAGE DATE 11 Jul 75	PARAGRAPH 2a, 2b

STS/CTS REFERENCE

NUMBER STS908X0	DATE 25 March 75

SUPERVISOR APPROVAL

SIGNATURE	DATE	SIGNATURE	DATE
William E Britz Jr	3 NOV 1975		

PRECLASS PREPARATION

EQUIPMENT LOCATED IN LABORATORY	EQUIPMENT FROM SUPPLY	CLASSIFIED MATERIAL	GRAPHIC AIDS AND UNCLASSIFIED MATERIAL
Training aids (Assorted preserved foods) (15)	None	None	See attached sheet

CRITERION OBJECTIVES AND TEACHING STEPS

2a. Identify common food storage procedures.

2b. Given applicable references, directives, and forms, and samples of a variety of preserved foods: determine condition of the product (including compliance with packaging, packing and marking requirements) and recommend appropriate disposition. Satisfactory achievement consists of attaining a score of not less than 70 percent when scored according to checklist 3ABR90830-X-2a.

(Teaching steps listed in Part II)

ATC FORM AUG 72 770

Graphic Aids and Unclassified Material Cont'd.

ST 3ABR90830-X-1
AFM 145-1, Commissary and Subsistence Depot Operating Manual
Transparencies, Food Technology Series

67

LESSON PLAN (Part I, General)

APPROVAL OFFICE AND DATE MSDV/Brits 30 Oct 75	INSTRUCTOR
COURSE NUMBER 3ABR90830	COURSE TITLE Veterinary Specialist
BLOCK NUMBER XI	BLOCK TITLE Animal Service and Zoonoses Control Activities

LESSON TITLE
Veterinary Responsibilities for Animal Service

LESSON DURATION

CLASSROOM /Laboratory 2 hrs	Complementary 0	TOTAL 2 hrs

POI REFERENCE

PAGE NUMBER 38	PAGE DATE 11 Jul 75	PARAGRAPH 1a

STS/CTS REFERENCE

NUMBER STS908X0	DATE 25 March 1975

SUPERVISOR APPROVAL

SIGNATURE	DATE	SIGNATURE	DATE
William E	30 Oct 75		

PRECLASS PREPARATION

EQUIPMENT LOCATED IN LABORATORY	EQUIPMENT FROM SUPPLY	CLASSIFIED MATERIAL	GRAPHIC AIDS AND UNCLASSIFIED MATERIAL
None	None	None	See attached sheet

CRITERION OBJECTIVES AND TEACHING STEPS

1a. Identify the responsibilities of the Veterinary Service for zoonoses control and care of private and government-owned animals.

(Teaching steps listed in Part II)

1-4

ATC FORM AUG 73 770

Graphic Aids and Unclassified Material Cont'd.

Transparencies, Animal Service Series
ST 3ABR90830-XI-1, Animal Service
~~AFM 163-11, Veterinary Services, USAF~~ BSC 14 Oct 75

69

LESSON PLAN (Part I, General)

APPROVAL OFFICE AND DATE USDV/Britz Bentz 30 Oct 75	INSTRUCTOR
COURSE NUMBER 3ABR90830	COURSE TITLE Veterinary Specialist
BLOCK NUMBER VI	BLOCK TITLE Animal Service and Zoonoses Control Activities

LESSON TITLE
Government Owned Animals

LESSON DURATION

CLASSROOM /Laboratory	Complementary	TOTAL
3 hrs	2 hrs	5 hrs

POI REFERENCE

PAGE NUMBER	PAGE DATE	PARAGRAPH
38	11 Jul 75	2a

STS/CTS REFERENCE

NUMBER	DATE
STS908X0	25 March 75

SUPERVISOR APPROVAL

SIGNATURE	DATE	SIGNATURE	DATE
William E Bentz	30 Oct 75		

PRECLASS PREPARATION

EQUIPMENT LOCATED IN LABORATORY	EQUIPMENT FROM SUPPLY	CLASSIFIED MATERIAL	GRAPHIC AIDS AND UNCLASSIFIED MATERIAL
None	None	None	See attached sheet

CRITERION OBJECTIVES AND TEACHING STEPS

2a. Identify activities of the Veterinary Service in support of government-owned animals (including preparation of reports and maintaining records and supplies).

(Teaching steps listed in Part II)

1-4

FORM 770
AUG 73

Graphic Aids and Unclassified Material Cont'd.

Transparencies, Animal Service Series
16mm Film - TF-6362, Dogs of the Air Force; Patrol Dogs (25 min)
ST 3ABP90830-XI-1
35mm Slides, Military Working Dog Series
~~AFM 125-5, Vols I and II, USAF Military Working Dog Program~~
~~AFR 125-5, USAF Military Working Dog Program~~
~~AFR 163-11~~
~~AFR 163-4, Prevention and Control of Communicable Diseases of Animals~~

DEC
14
Oct 75

LESSON PLAN (Part I, General)

APPROVAL OFFICE AND DATE MSDV/Britz Brit, 30 Oct 75	INSTRUCTOR
COURSE NUMBER 3ABR90830	COURSE TITLE Veterinary Specialist
BLOCK NUMBER XI	BLOCK TITLE Animal Service and Zoonoses Control Activities

LESSON TITLE
Subprofessional Clinical Procedures

LESSON DURATION

CLASSROOM /Laboratory	Complementary	TOTAL
8 hrs	2 hrs	10 hrs

POI REFERENCE

PAGE NUMBER	PAGE DATE	PARAGRAPH
39	11 Jul 75	3a

STS/CTS REFERENCE

NUMBER	DATE
STS908X0	25 March 75

SUPERVISOR APPROVAL

SIGNATURE	DATE	SIGNATURE	DATE
William E Britz, Jr.	30 Oct 75		

PRECLASS PREPARATION

EQUIPMENT LOCATED IN LABORATORY	EQUIPMENT FROM SUPPLY	CLASSIFIED MATERIAL	GRAPHIC AIDS AND UNCLASSIFIED MATERIAL
Dog Skeleton (15) Restraint Devices (15) Radiographic Viewer (15) Assorted Surgical Instruments (15) Assorted Syringes and Needles (15)	None	None	See attached sheet

CRITERION OBJECTIVES AND TEACHING STEPS

3a. Recognize the responsibilities and limitations in providing subprofessional clinical advice and assistance in the handling, care, and treatment of animals.

(Teaching steps listed in Part II)

1-4

ATC FORM AUG 72 770

Graphic Aids and Unclassified Material (Cont'd).

Transparencies, Animal Service Series
35mm Slides, Animal Service Series
16mm Film - TF-6073, Dogs of the Air Force, Care and First Aid (25 min)
16mm Film - PA 228, Parenteral Medication of Sentry Dogs (14 min)
ST 3ABR90830-PI-1
~~35mm Slides, Animal Service Series~~
~~AFR 161-1-9, Immunizations~~
~~AFR 163-4, Prevention and Control of Communicable Diseases of Animals~~
~~AFR 163-11~~

73

APPROVAL OFFICE AND DATE MSDM/Bates Bentz 30 Oct 75	INSTRUCTOR
COURSE NUMBER 3ABR90830	COURSE TITLE Veterinary Specialist
BLOCK NUMBER XI	BLOCK TITLE Animal Service and Zoonoses Control Activities

LESSON TITLE
Identification and Control of Communicable/Zoonotic Diseases

LESSON DURATION

CLASSROOM /Laboratory 16 hrs	Complementary 2 hrs	TOTAL 18 hrs

POI REFERENCE

PAGE NUMBER 41	PAGE DATE 11 Jul 75	PARAGRAPH 5a

STS/CTS REFERENCE

NUMBER STS908X0	DATE 25 March 75

SUPERVISOR APPROVAL

SIGNATURE	DATE	SIGNATURE	DATE
William E Bentz Jr	30 Oct 75		

PRECLASS PREPARATION

EQUIPMENT LOCATED IN LABORATORY	EQUIPMENT FROM SUPPLY	CLASSIFIED MATERIAL	GRAPHIC AIDS AND UNCLASSIFIED MATERIAL
Microscopes (1) Fecalizers (1) Parasite-Preserved Specimen (1) Prepared Microscopic Slides (1)	None	None	See attached sheet

CRITERION OBJECTIVES AND TEACHING STEPS

5a. Given necessary information, current publications, directives, laboratory equipment, and fecal specimens, use proper laboratory techniques to identify certain causative agents of communicable/zoonotic diseases. Satisfactory achievement is accomplished by attaining a score of not less than 70 percent when scored according to a checklist 3ABR90830-XI-5a.

(Teaching steps listed in Part II)

1-4

ATC FORM AUG 72 770

74

Graphic Aids and Unclassified Material Cont'd.

Transparencies, Animal Service Series
ST 3ABR90830-VI-1
SW 3ABR90830 VI-5, Parasitology
Audiovisual Slide/Sound Program - Parasitology
~~AFM 160-4, Prevention and Control of Communicable Diseases of Animals~~ Dsc 14 Oct 75
16mm Film - TF 1-8054, Ascariasis (17 min)
16mm Film - TF-6076, Sentry Dogs, Disease Prevention (25 min)
16mm Film - FLC 12-37, Leptospirosis (13 min)
16mm Film - FLC 20-60, Tick and Tick-Borne Diseases (24 min)
16mm Film - FLC 1-187 Animal Bites and Rabies (16 min)
16mm Film - FLC 4-0096, Diroflaria Immitis, Development and Transmission (16 min)

EPARE THE MAN

STUDENT TEXT 3ABR90830-VII-1

30BR9921-1-II-7b

75

DEPARTMENT OF VETERINARY MEDICINE

VETERINARY SPECIALIST

POULTRY INSPECTION

July 1974

1-4

SCHOOL OF HEALTH CARE SCIENCES, USAF
SHEPPARD AIR FORCE BASE, TEXAS

Designed For ATC Course Use

DO NOT USE ON THE JOB

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Study Guides, Workbooks, Programmed Texts and Handouts are training publications authorized by Air Training Command (ATC) for student use in ATC courses.

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Department of Veterinary Medicine
School of Health Care Sciences, USAF
Sheppard AFB, Texas

ST 3ABR90830-VII-1
3OBR9921-1-II-7b

POULTRY INSPECTION

INTRODUCTION

Material presented in this chapter will provide you with information pertaining to approved sources of poultry for procurement by the military services and to the aims of our various inspections. Sanitary requirements of poultry processing facilities are discussed as are poultry anatomy and physiology as they relate to ante-mortem and post-mortem inspections. Processing steps one described and specification requirements are discussed. Receipt and surveillance inspection procedures are discussed and sources of additional information are provided.

SOURCES

In the United States, Federal Specification PP-C-248H requires that, "The product shall be prepared in an establishment operating under continuous inspection by the Animal and Plant Health Inspection Service, United States Department of Agricultral and shall be inspected, passed, and marked in accordance with Poultry Products Inspection Regulations."

In oversea areas most poultry still comes from the United States. In some cases, however, we may resort to local procurement. In this case it is usually as a result of local quarantine regulations (such as in the UK) which ban the entry of US poultry. In such cases, ante-mortem and post-mortem inspections and sanitary surveillance of processing plants and operations is accomplished by the military veterinary services.

AIMS OF INSPECTION

In accomplishing inspection of poultry, our aims are to insure that the product:

1. Is not derived from animals in an abnormal physiological state.
2. Does not contain morbid, necrotic or neoplastic tissue.
3. Does not contain pathogens of toxic substances.
4. Does not become contaminated or otherwise unfit for human consumption subsequent to processing.

To meet the aims, we perform the following inspections:

1. Supervision of plant sanitation.
2. Ante-mortem.
3. Post-mortem.
4. Supervision of further processing; i.e., canning and the preparation of frozen pies, etc.
5. Supervision of marking and labeling.
6. Disposal of condemned unwholesome carcasses and unfit parts.

This supersedes SG 3ABR90830-X-1, May 1973, which may be used until supply on hand is exhausted.

In performing our inspections, we must remember that we can only reject; the USDA and/or the FDA can condemn. We must watch very closely on Class 3 inspections to assure that carcasses or parts rejected on Class 1 or Class 2 inspections do not get back in with passed products.

SANITARY REQUIREMENTS OF POULTRY PROCESSING FACILITIES

NOTE: Detailed information concerning the minimum standards for sanitation, facilities, and operating procedures in official, plants can be found in 7CFR, Part 70 , Grading and Inspection of Poultry and Edible Products Thereof and United States Classes, Standards, and Grades with Respect Thereto. The following items have been extracted from these regulations.

BUILDINGS: The buildings shall be of sound construction and kept in good repair, and shall be of such construction as to prevent the entrance or harboring of vermin.

1. Outside openings, except to receiving rooms and feeding rooms, shall be properly fitted with screens.

2. Doors shall:

   a. Be hung so that not over 1/4" clearance remains when closed.

   b. Open toward the outside.

   c. Be provided with self-closing devices.

ROOMS AND COMPARTMENTS:

1. Rooms, compartments, or receptacles used for edible products shall be separate and distinct from areas where inedible products are held and from rooms where live poultry is held or slaughtered.

2. Separate rooms are required for the following operations or activities:

   a. Receiving and feeding of live poultry.

   b. Killing, scalding, and roughing operations.

   c. Pinning and finishing.

   d. Evisceration operations - final pinning, chilling, and packaging of edible products may be performed in this room.

   e. Inedible products departments.

   f. Refuse rooms.

3. Rooms for holding carcasses for further inspection:

   a. Shall be equipped with locks and keys and the keys shall not leave the custody of the inspector in charge.

   b. Shall be marked with the word "RETAINED" in 2" letters.

4. Coolers and freezers - adequate to reduce internal temperature of RTC poultry to maximum of 36°F. within 24 hours (unless other cooling facilities are available).

5. Refuse rooms:

   a. Entirely separate from other rooms in the plant.

   b. Shall have tight fitting doors.

   c. Shall be properly ventialted.

6. Storage and supply rooms - in good repair, kept dry, and maintained in a sanitary condition.

7. Toilet rooms - shall have self-closing doors and shall be ventilated to the outside of the building.

FLOORS, WALLS, AND CEILINGS:

1. Shall be made of material which will facilitate easy cleaning.

2. Floors:

   a. Should be of hardened concrete or tile with impervious joint material in good repair.

   b. Should be graded for complete run-off with no standing water.

3. Ceilings and walls - must be impervious to moisture and have a smooth surface to permit easy cleaning.

4. Bleeding area:

   a. Must be cleaned daily.

   b. Must be of sufficient size to allow complete bleeding before carcasses leave the area.

   c. Catch basin for blood must be large enough for a day's run at peak capacity or must be flushed continuously.

WATER SUPPLY:

1. Shall be ample, clean, and potable with adequate pressure and protected against contamination.

2. Sufficient hose connections shall be located throughout the plant for cleaning operations.

3. Hot water not less than 180°F. shall be available for sanitation purposes.

4. Refuse rooms shall be provided with adequate facilities for washing the rooms, containers, etc.

LAVATORY ACCOMMODATIONS:

1. Adequate lavatory and toilet facilities shall include at least hot and cold water, soap and (single-use) towels.

2. Metals waste containers shall be provided.

3. An adequate number of handwashing facilities serving areas where dressed poultry and edible products are prepared shall be operated by other than hand-operated controls.

4. Signs shall be posted directing employees to wash hands before returning to work after going to toilet or locker rooms.

EQUIPMENT AND UTENSILS:

1. Must be of such construction and material as to facilitate thorough cleaning; should be metal with no sharp corners, no cracks, and no seams.

2. Equipment used for inedible products shall be distinctly marked and shall not be used for any other purpose.

3. Refuse containers shall be of metal and shall be kept covered.

4. Scalding equipment

a. May be tank or spray type, but either shall be of metal for ease of cleaning.

b. Must be constructed so as to prevent contamination of potable water lines.

c. Tanks, when used, must permit water to enter continuously at the rate of 1/4 gallon per bird per minute and to flow out through an overflow.

5. Ice chilling vats shall be of metal or other hard surfaced impervious material; ice shovels shall be made of smooth surfaced metal.

6. Conveyors

a. Shall be of metal or other acceptable material and of such construction as to permit thorough and ready cleaning.

b. Overhead conveyors must not collect moisture or allow grease, dirt, or oil to accumulate on the drop chains or shackles.

c. Viscera must accompany carcass so that they are together on the line; if viscera is completely removed, a trough moving with the shackle line must be provided.

The work performed in ante-mortem and post-mortem inspections is of little value unless the plant and its equipment and facilities are constructed, maintained and operated in a clean, sanitary manner.

MISCELLANEOUS INFORMATION RELATING TO POULTRY PLANT SANITATION

Ice - must be made from potable water and must be handled in a sanitary manner.

Rodents - best product to use in control is Warfarin; use 1:20 of a 0.5% powder, leave in place until 8-10 days after feeding stops, repeat in 30-60 days; bait pans vs. bait boxes; turn traps "head in" to wall.

Insects - a white strip around the perimeter of room 12" wide and 12" up the walls will help greatly by making dirt and other attractants more easily seen by cleanup personnel; screen wire should be no larger than 16 mesh; fly fans across all openings to outside that may be open for other than immediate passage; residual insect sprays not allowed in parts of plant where products are handled; do not use residual sprays in kerosene close enough to the product that the odor may be picked up.

Sweeping - industrial vacuum cleaners are far better; use sweeping compounds for dry sweeping.

Steel wool or wire bristle brushes - do not allow them.

Personnel working in poultry plants should be treated as food handlers because they are food handlers.

Sewage - a plant that kills 2,000 birds per day presents sewage problems equal to a town of 1,000 people.

Cleaning up blood - use cold water first, then hot water.

Chlorine solutions for sanitizing:

Metal equipment - 200 ppm
Wood equipment - 1,000 ppm
Walls, etc. for mold and slime control - 1,000 ppm
(rinse metal quickly to prevent corrosion)

$$\frac{\text{Strength of rinse desired (ppm)}}{\text{Strength of stock solution (\%)}} \times \frac{\text{Gallons rinse desired}}{75} = \text{ounces to stock solution to use.}$$

Alkaline detergents routinely used - sodium carbonate, sodium hydroxide, sodium metasilicate, trisodium phosphate, tetrasodium pyrophosphate, sodium hexametaphosphate.

Acid detergents - use periodically to remove scale from hard water precipitates; muriatic acid, sodium acid sulfate or bisulfate of soda, acetic acid, glycolic acid or hydroxyacetic acid.

Equipment - metal, no sharp corners, no cracks, no seams.

AVIAN ANATOMY AND PHYSIOLOGY

INTRODUCTION: The anatomy of the chicken can be easily compared to that of the bovine species with a few exceptions. The anatomical structures of the chicken have practically the same nomenclature as those of other animals and similar, if not the same, functions.

SKELETAL SYSTEM:

1. The axial skeleton - skull, vertebral column, ribs, and sternum.

a. The skull - two large orbits surrounding the brain. The bones of the face form a somewhat sharp and pointed cone.

b. Vertebral column

(1) Vertebral formula is $C_{14}\ T_7\ L\text{-}S_{14}\ Cy_6$; note that birds have considerably more cervical, lumbar, and sacral vertebra and fewer thoracic and coccygeal vertebra than do members of the bovine species.

(2) The lumbar and sacral vertebra are fused and the pelvic girdle is fused to them.

(3) The coccygeal vertebra are fused with the sacral mass at the front and the last few are fused to form the "pygostyle."

c. Sternum - large in relation to other bones of the skeleton, due to the attachment of flight muscles; referred to as the "keel bone."

2. The appendicular skeleton.

a. Thoracic limb

(1) Scapula, coracoid, and clavicle make up the shoulder girdle.

(2) The clavicle is referred to as the "wish bone."

b. Pelvic lumb

(1) Pelvis (ilium, ischium, and pubis) is fused with the lumbo-sacral mass.

(2) Tibia is referred to as the "drumstick."

MUSCULATURE:

1. Suited to fit the special needs of flight (heavy thoracic and breast muscles).

2. Diaphragm does not separate the thoracic and abdominal cavities, but merely separates the lungs from the viscera.

DIGESTIVE SYSTEM:

1. The mouth

a. Has no lips or cheeks.

b. Teeth are absent.

c. Jaws are curved to form a beak.

d. Tongue is narrow and triangular.

e. The hard pallet has horny papillae protruding from it and directed backwards.

2. Esophagus

a. Leads from mouth to proventriculus.

b. Near the thoracic inlet and lying on the right side of the median line is the crop, a sac-like part of the esophagus which serves as a storehouse for food.

3. Stomach

a. Proventriculus - the true glandular stomach.

b. Gizzard - the muscular stomach; may find gravel in the gizzard to aid in the grinding of food.

4. Small intestines - most digestion takes place here; long in most birds, short in carnivores.

5. Large intestines

a. Two ceca - blind sacs approximately 7" long which empty into the intestine at the junction of the large and small intestines.

b. Colon.

6. Cloaca - common to both the digestive and reproductive tracts; opens to the outside through the vent.

7. Accessory organs of digestion

a. Liver - lies in the ventral part of the body cavity to the right of the median line.

b. Pancreas - narrow gland lying near the first part of the small intestine.

c. Spleen - lies near the junction of the glandular and muscular stomachs, dorsally and to the right.

RESPIRATORY SYSTEM:

1. Nostrils - open through the upper part of the beak.

2. Nasal cavities.

3. Cranial larynx.

4. Trachea - long tube with complete cartilagenous rings.

5. Syrinx (posterior larynx) located at terminal end of the trachea, partly formed by the bronchi; the "voice box."

6. Lungs - relatively small and occupy most of the dorsal part of the thoracic cavity.

7. Air sacs - serve as a means of communication between the bronchi; found within the long bones, inside the body cavities, and between muscles; may become contaminated due to improper processing.

a. Cervical - paired.

b. Clavicular - single.

c. Axillary - paired.

d. Anterior thoracic - paired.

e. Posterior thoracic - paired.

f. Abdominal - paired.

UROGENITAL SYSTEM:

1. Kidneys

a. Lie on either side of the vertebral column extending posteriorly from the sixth rib.

b. Dark red in color.

c. Ureates pass through the ureters to the cloaca and are passed out with fecal matter.

2. Male genital organs - testicles lie ventrally to the anterior lobes of the kidneys.

3. Female genital organs

a. Ovaries and oviducts.

b. Right ovary usually not functional.

c. Oviduct empties into the cloaca.

CIRCULATORY SYSTEM:

NERVOUS SYSTEM:

INTEGUMENT:

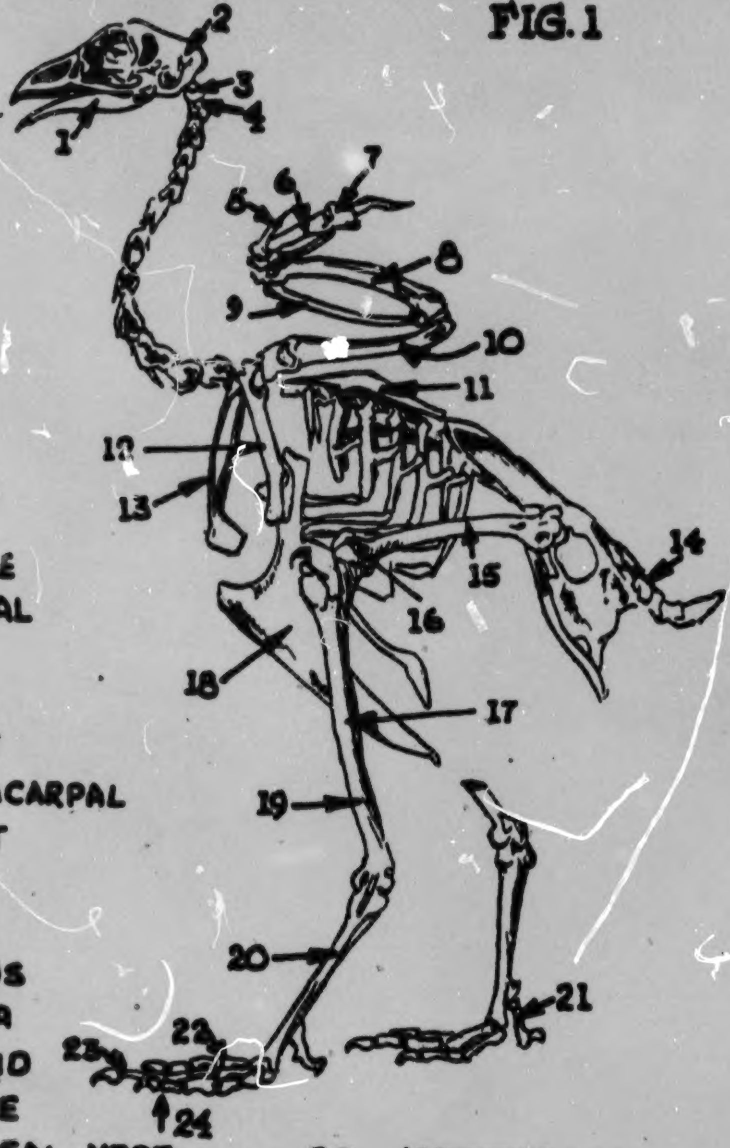
1. Feathers.

2. Vestigial feathers - hair or down.

3. Oil gland - located in the skin above the pygostyle.

SKELETON OF THE CHICKEN

FIG. 1



1. MANDIBLE
2. OCCIPITAL
3. ATLAS
4. AXIS
5. 1ST DIGIT
6. 2ND METACARPAL
7. 2ND DIGIT
8. ULNA
9. RADIUS
10. HUMERUS
11. SCAPULA
12. CORACOID
13. CLAVICLE
14. COCCYGEAL VERT.
15. FEMUR
16. PATELLA
17. FIBULA
18. STERNUM
19. TIBIA
20. METATARSUS
21. 1ST DIGIT
22. 2ND DIGIT
23. 3RD DIGIT
24. 4TH DIGIT

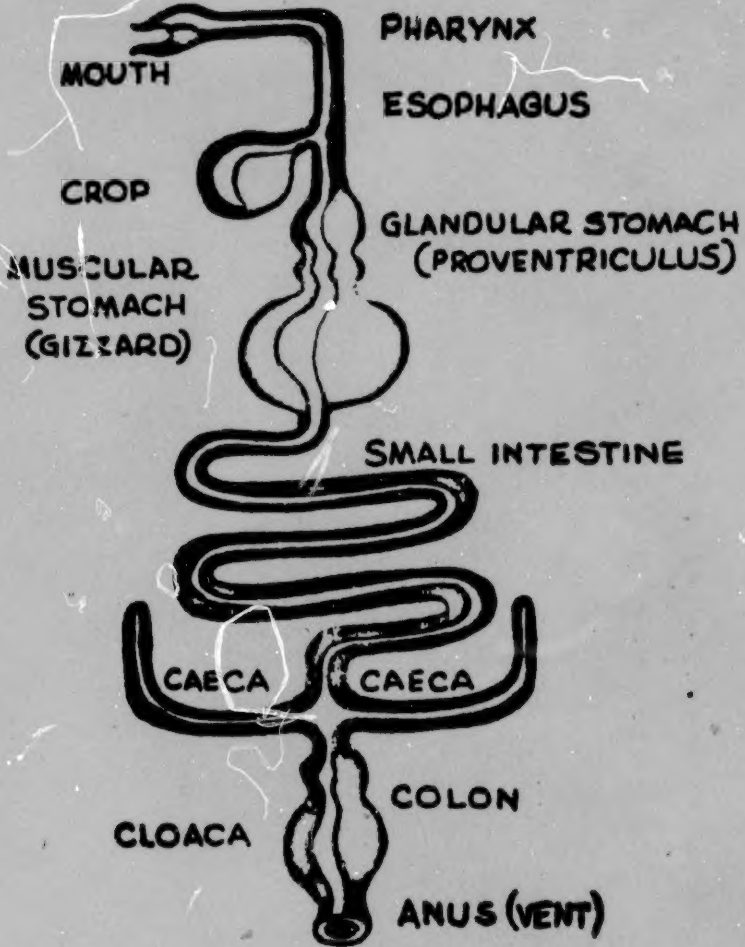
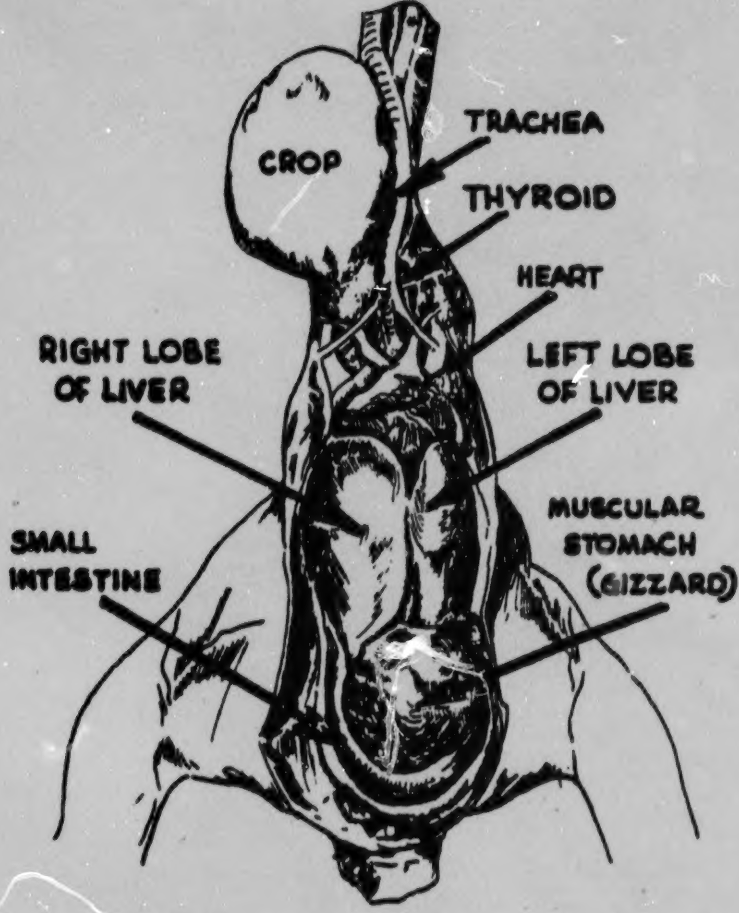


FIG. 2 SCHEMATIC REPRESENTATION OF A CHICKENS DIGESTIVE SYSTEM.



DIGESTIVE SYSTEM OF THE CHICKEN (VENTRAL)
FIG. 3

ANTE-MORTEM AND POST-MORTEM INSPECTION

NOTE: Anyone who is actively engaged in Class 1 and/or Class 2 inspection of poultry or poultry products should obtain a copy of Examination and Evaluation of Poultry and Poultry Products, published by the U.S. Department of Health, Education, and Welfare. This is a joint USPHS and FFDA publication. Further he or she should thoroughly familiar with the requirement of 9CFR Part 381, Poultry Products Inspection Regulations.

ANTE-MORTEM INSPECTION:

1. Birds are viewed in their coops and batteries in the holding area.

2. Our aims are to:

   a. Prevent the slaughter, for processing, of birds which can be detected (while alive) as being unfit for human consumption.

   b. Prevent exposure of plant employees to diseased poultry.

   c. Minimize contamination of the processing plant and equipment, employees' hands, and healthy birds.

   d. Prevent the approval of carcasses on post-mortem inspection alone because of a lack of readily identifiable lesions when ante-mortem lesions would have warranted rejection (especially true with respiratory and nervous system infections).

3. Obviously ill birds are removed. No specific diagnosis is necessary and no specific justification for your rejection is required.

4. Reject birds showing the following:

   a. Down, unable to stand.

   b. Partial paralysis, nervous disturbances, convulsive movements.

   c. Emaciation - extreme thinness or weakness.

   d. Extensive, numerous, or repulsive scabs, nodules, blisters, ulcers, wounds, abscesses or inflamed areas.

   e. Marked enlargement of bones, especially of wings or legs.

   f. Multiple tumors.

   g. Greatly distended abdomen.

   h. Unthrifty appearance, drowsiness, or droopiness.

   i. Discolored comb.

   j. Difficult respiration. nasal discharge, swollen eyes, or swollen head sinuses.

   k. In turkeys, an erect snood - pathognomic of erysipelas.

5. In case of high rates of infection:

   a. May class birds as "Suspect," segregate them, and slaughter them at the end of the day.

b. May notify state livestock sanitary authority and await their recommendations.

POST-MORTEM INSPECTION:

1. Post-mortem inspection is a professional duty and must be done by or under the supervision of a DVM at all times.

2. One inspector can examine a maximum of about 720 birds per hour (one every 5 seconds); lines often move at 1200 to 2300 birds per hour.

3. The viscera and both the inner and outer surfaces of the carcass should be closely observed. The following should be noted:

a. Exterior surface - cuts, tears, bruises, broken bones, discolorations, contamination, general condition.

b. Interior surfaces - accumulations of pus or slimy material in the cavities, growths, inflamed appearance of pleura and/or peritoneum, or thickened pleura and/or peritoneum; all are causes for rejection.

4. The viscera are examined, both visually and by palpation. A simple way is to hold the gizzard in the palm of the left hand so that the liver and spleen are easily observed (along with the heart and intestines) and can be manipulated with the thumb and first two fingers of the right hand.

a. Gizzard

(1) The muscular stomach; normally a dark red with a definite sheen.

(2) Note abscesses, necrosis, foreign body penetration, and parasites in the walls.

b. Spleen

(1) Normally a deep bluish red in color; varies considerably in size.

(2) Note tumors, off-color, marked shrinking, nodules.

c. Liver

(1) Normally a deep red in color except in old birds they are lighter.

(2) Note marked enlargements, ulcers, nodules, tumors, cysts, discolorations, and fibrous coverings.

(a) Greenish cast usually due to Salmonellae.

(b) T. B. will produce tiny necrotic foci about the size of a millet seed.

(c) Marked enlargement - visceral lymphomatosis ("big liver disease").

(d) Blackhead lesions in turkeys.

(3) Slice and fold the cut edges back together to determine swelling.

d. Heart

(1) Normally has some fat on base and about the middle.

(2) Note hemorrhages, ureates inside of or on the pericardium, amount and character of fluid in the pericardial sac and absence of any heart fat.

e. Intestines

(1) Normally some food present, upper portion pink in color, ceca and lower portions darker.

(2) Note discoloration, nodules and tumors, adhesions, and engorgement of mesenteric vessels (indicates "cold slaughter").

f. Kidneys

(1) Normally deep red in color.

(2) Note swelling, tumors, cysts, and abnormal colors.

g. Lungs

(1) Normally a light pink in color.

(2) Note adhesions, discolorations, nodules.

h. Reproductive organs - note presence of tumors.

5. Remember that the presence of lesions in individual organs may or may not necessitate rejection of the entire carcass. Findings in individual organs must be correlated with what is seen elsewhere. Localized lesions may call only for rejection of the particular organ or part.

6. Disposal of rejected carcasses and/or parts.

a. We can only reject, FDA and USDA can condemn.

b. Recommended disposal methods:

(1) Incineration - complete destruction by burning.

(2) Chemical denaturing - crude oil, kerosene, etc.

(3) Steam sterilization.

c. If you are performing the Class 1 and Class 2 inspections, remember to note carefully on your Class 3 to assure that no previously rejected carcasses and/or parts have been reoffered.

DISEASES AND OTHER ABNORMAL CONDITIONS

In the conduct of ante-mortem and post-mortem inspections, it is usually impossible to make a definite diagnosis.

Conditions usually diagnosed:

1. Tuberculosis.
2. Emaciation.
3. Septicemia and toxemia.
4. Lymphomatosis.
5. Tumors.
6. Inflammatory processes.
7. Parasites.

There are at least 26 zoonotic diseases of poultry recognized at this time. The ones considered to be of greatest significance are:

1. Salmonellosis.
2. Staphylococcal infections.
3. Erysipelas.
4. Psittacosis.
5. Pneumoencephalitis (Newcastle).

Respiratory diseases - of special interest because the air sacs extend into the body cavities, intermuscular spaces and long bones and infections of the respiratory system often involve edible parts.

1. Psittacosis:
    a. A virus infection found in over 70 species of birds, most common in the psittacine group.
    b. Turkeys - a frequent carrier to humans.
    c. AM findings - greenish blood-tinged diarrhea, droopy appearance, respiratory involvement.
    d. PM findings - thickened air sacs, enlarged liver with a plastic film covering it, excessive pericardial fluid, swollen lungs.
    c. Disposition - reject.
2. Newcastle Disease:
    a. A virus infection, primarily of fryer-aged birds.
    b. AM findings - diarrhea, brown or watery nasal discharge, respiratory involvement, ± nervous involvement.

c. PM findings - air sacs thickened and often have a yellowish exudate, multiple hemorrhages, and necrotic lesions in the viscera.

d. Disposition - reject active cases, pass if recovered.

3. Tuberculosis:

a. Avian tuberculosis rarely affects man but is frequently found in swine.

b. A major cause of rejection in older poultry.

c. AM findings - emaciation, atrophy of breast bone, dullness and depression, ± affected gait if bone marrow is involved.

d. PM findings - small yellow-white granular nodules in liver, spleen and/or intestines, and/or lungs.

e. Disposition - reject in event of any evidence at all.

4. Salmonellosis:

a. Pullorum:

(1) AM findings - whitish diarrhea.

(2) PM findings - thickened heart sac and yellow-white nodules on lungs, liver, gizzard and heart.

b. Fowl typhoid:

(1) AM findings -greenish yellow diarrhea.

(2) PM findings - greenish colored liver and enlarged spleen.

c. Dispostion - reject.

Lymphomatosis - a group of transmissible diseases generally characterized by tumor formation; common in poultry but not known to affect man.

1. Visceral lymphomatosis ("Big liver disease") - markedly enlarged liver ± tumorous involvement of other internal organs.

2. Neural lymphomatosis - may note partial paralysis in live birds; greatly enlarged nerves often noted on PM.

3. Ocular lymphomatosis - often note a triangular shaped pupil.

4. Osteopetrosis - malformation of long bones, crowding the bloodforming tissues, often resulting in anemia.

5. Disposition - reject.

Tumors:

1. Reject part or organ affected.

2. Reject entire carcass if general condition of bird is affected.

Fowlpox:

1. A viral disease not transmissible to man.
2. Lesions most common about head, on comb, and on wattles.
3. Disposition - reject.

Parasitisms:

1. Reject affected organs.
2. Reject entire carcass if systemic involvement is noted.

Emaciation:

1. Extreme thinness, tissues often gelatinous.
2. Indicates prolonged effect of disease or of starvation.
3. Disposition - reject.

Septicemia and Toxemia

1. Caused by pathogenic bacteria and the toxins.
2. Usually identified by paralysis of the bird, but positive identification requires a blood sample.

Inflammatory processes:

1. Inflammed areas of the bird usually caused by a cut, tear, or bruise.
2. Disposition - will depend on the location.

Staphylococcal infections:

1. Caused by Staphylococci.
2. Can affect the skin or internal organs.
3. Disposition - reject.

Erysipelas (Erysipelothrix):

1. Disease of the skin and subcutaneous tissue.
2. Disposition - reject.

Listeriosis:

1. Affects the nervous system of birds.
2. Symptoms would be paralysis.
3. Disposition - reject.

Botulism:

1. Food poisoning caused by toxin of bacteria.
2. Symptoms would be a diarrhea, cough, and a staggering gate.
3. Disposition - reject.

Blackhead

1. Is an inflammation of the bowel and liver.
2. Characterized by a discoloration of the comb.
3. Disposition - reject if active or severe.

Inf. laryngotracheitis:

1. Caused by a virus infection.
2. Inflammation of the larynx and trachea.
3. Disposition - reject if active or severe.

Inf. coryza:

1. Cold located in the head.
2. Characterized by nasal drainage.
3. Disposition - reject if active or severe.

Cold slaughter

1. Engorgement of mesenteric vessels will be noted.
2. Disposition - reject.

Other conditions whose disposition will depend upon extent, location, etc.:

1. Bruises.
2. Contamination - by oils, fecal matter, paint, etc.
3. Mutilation - due to rough handling during processing.
4. Over-scaled - will present a reddened or cooked appearance.

Summary:

1. Diseases or conditions causing rejection in any degree seen:

   Tuberculosis
   Pseudo-tuberculosis
   Salmonellosis
   Lymphomatosis
   Psittacosis
   Listeriosis
   Erysipelothrix
   Botulism
   Emaciation
   Cold slaughter

2. Rejectable if severe or active:

   Newcastle
   Fowl typhoid
   Fowl cholera
   Pullorum
   Blackhead
   Parasitisms
   Inf. laryngotracheitis
   Inf. coryza
   Chronic Respiratory Disease (CRD)
   Fowl Pox
   Inflammatory Processes

POULTRY PROCESSING

INTRODUCTION - In order to accomplish adequate inspection of poultry and poultry products and to better visualize possible problems which may arise in connection with these foods, it is necessary that you have a general knowledge of the various procedures involved in processing.

RECEIVING - Live birds are usually transported to the plants in wooden coops or crates. The handling that they receive during transit has a very definite effect on the quality of the finished product.

HOLDING - Ante-mortem inspection is accomplished during the hold period.

1. Long Term Holding - varies from 1-10 days, usually not more than 2-3; birds are fed and watered during this period to:

   a. Restore "bloom."

   b. Regain weight losses.

   c. Restore water to tissues.

   d. Assure a continual supply of birds for the processing operation.

2. Short Term Holding - held just long enough to keep the processing operation going, usually 2-3 hours.

SHACKLING - Birds are hung by their feet onto the shackle line which conveys them throughout the operation.

SLAUGHTERING -

1. Kosher - severing the blood vessels on one side of the neck.

2. Modified Kosher - severing the neck vessels (but not the esophagus or trachea) on both sides of the neck.

3. Pithing - a knife is inserted into the mouth, the vessels in the throat are cut, the knife is partially withdrawn and then the brain is pierced.

4. Electrical - electric shock in addition to severance of blood vessels.

5. Mechanical - various automatic devices, none to date do an acceptable job.

BLEEDING

1. From 50 to 70 seconds required for complete bleeding.

2. Bleeding must be confined so that accumulated blood can be collected and removed.

3. Birds are not allowed on the floor at any time following slaughter.

DRESSING OPERATIONS (Procedures prior to evisceration) -

1. Scalding - aids in loosening feathers.

   a. Vat or spray - if vat is used, water must flow continuously at rate of 1 quart per bird per minute.

b. Temperatures.

(1) Semi-scald - 126-130°F.

(2) Sub-scald - 138-140°F. (most commonly used.)

(3) Hard-scald - 160-170°F.

2. Roughing - birds are passed between two revolving drums with rubber fingers which remove the feathers; they pass through one set, then are removed from the shackles, hung by the neck instead of by the feet, and are then passed through a second set.

3. Washing - spray with potable water under pressure.

4. Pinning - hand removal of vestigial feathers.

5. Singeing - passed through a gas flame to remove hair and down.

6. Removal of feet - may be done here or later, usually here.

7. Washing - spray with potable water under pressure.

8. At this point, the "Dressing" is complete. Birds sold as New York Dressed are not eviscerated but only vented and have the food removed from the crop. The DOD buys NO New York Dressed poultry and little is sold on the commercial market today.

EVISCERATION - Birds are transferred to another shackle line which goes into a separate room for evisceration.

1. Must be accomplished in a room separate from areas where live birds are held or where inedible products are handled.

2. Removal of feet (if not previously accomplished) - some areas require that feet be presented at time of post-mortem inspection because of high incidence of joint infections.

3. Removal of oil gland.

a. Located in skin over base of pygostyle.

b. Removed to prevent undesirable flavors in finished product.

4. Slitting of neck - skin of the neck is incised to facilitate removal of trachea, esophagus and crop.

5. Three point suspension - birds are suspended by feet and neck in preparation for evisceration.

6. Abdominal incision - must use care not to severe any internal organs.

a. Horizontal incision.

b. V-incision.

c. J-incision.

7. Removal of viscera - removed manually; either left hanging attached to the carcass or placed in trays beneath the carcass which move the carcass.

8. Post-mortem inspection.

9. Trimming of damaged or diseased parts - any bird so trimmed then goes into cut-up styles.

10. Removal of giblets.

   a. Heart - pericardium removed, heart cap cut off.

   b. Gizzard - opened, contents flushed, lining removed, trimmed.

   c. Liver - gall bladder removed, liver washed.

11. Removal of inedible carcass components.

   a. Intestines and attached organs are detached and discarded.

   b. Head is removed beyond point of pithing or sticking and contaminated neck parts are removed with it and discarded.

   c. Trachea, esophagus and crop are removed by pulling them through the incision in the neck.

   d. Removal of lungs and gonads by scraper or by suction; kidneys are left in.

12. Removal of neck for inclusion with giblets.

13. Final washing of carcass - inside and outside with potable water under pressure.

14. Inspection by plant inspector to assure complete removal of inedible parts.

WEIGHT SORTING - automatic drop according to weight of carcass; dropped into chill vats.

CHILLING -

1. Water cooling - birds chilled to a maximum of 40°F. and held at not more than 40°F. except during further processing they may go to 55°F.

   Under 4 lbs - within 4 hrs.
   4-8 lbs - within 6 hrs.
   Over 8 lbs - within 8 hrs.

2. Air cooling - RTC birds chilled to 40°F. maximum within 16 hours.

3. Giblets chilled to maximum of 40°F. within 2 hours.

4. Freezing - packaged poultry for freezing must go into the freezer within 48 hours after packaging; freezing of RTC poultry to 0°F. or below must take not more than 72 hours.

GRADING -

1. Usually accomplished after chilling; may be done as they are removed from the shackle line instead of being automatically sorted according to weight.

2. May be done by USDA certified plant personnel with spot checks by USDA (or military veterinary service) inspectors.

3. May be done by official USDA graders.

PACKING AND PACKAGING - according to purchase order.

SHIPPING -

1. Product must be in excellent condition at time of delivery.

2. Frozen poultry must be held at not higher than 0°F. after being frozen and at time of delivery (Federal Specification, PP-C-248H).

POULTRY CLASSIFICATION

GENERAL: Poultry is classified in various ways for DOD procurement. The initial classification deals with the Species. This includes primarily chickens, turkeys, and ducks; geese, guineas, and pigeons are not normally procured. In order to assure standardization of the product, the requirements of each Species are further divided into Type, Class, Style, and Grade.

CHICKENS:

1. TYPE - refers to state of refrigeration and duration of storage in the vendor's possession.

   a. Type I - fresh chilled. Eviscerated warm, chilled immediately to an internal temperature not higher than 36°F. delivered to destination at an internal temperature not higher than 38°F. (but not frozen) within 4 days after slaughtering.

   b. Type II - frozen not more than 60 days.

   c. Type III - frozen more than 60 days but not more than 120 days if for export nor more than 180 days if for domestic use.

   d. Type IV - frozen special. Eviscerated warm followed by immediately chilling. Hold at not higher than 38°F. until in freezer; packaged and replaced into freezer within 36 hrs after slaughter and within freezer not more than 6 hrs. after packaging. Frozen to not more than 0°F. internal temperature within 72 hrs. of slaughter.

   e. Type V - individually quick frozen (Class 1 and Styles 2,3,4, or 5 only)

2. CLASS - based on age, sex.

   a. Class 1 - Broiler-Fryers - 9 to 12 weeks of age, of either sex.

   b. Class 2 - Roasters - young birds usually 3 to 5 months of either sex.

   c. Class 3 - Stags - male chickens that have not attained full maturity.

   d. Class 4 - Capons - surgically castrated male chickens.

   e. Class 5 - Fowl (hens) - mature female chickens.

   f. Class 6 - Cocks - old males usually having been used for breeding.

   g. Class 7 - Rock Cornish Game Hen

3. STYLE - only Ready-To-Cook birds are procured by the DOD.

   a. Style 1 - Ready-To-Cook Whole.

b. Style 2 - Ready-To-Cook, Halves (Split) - Confined to Class 1 chickens. Style 1 chickens which have been further processed by making a full length back and breast split so as to produce right and left sides.

c. Style 3 - Ready-To-Cook, Quartered - Confined to Class 1 chickens. Style 2 birds that are further processed by cutting crosswise at right angles to the backbone so as to produce fore quarters of all white meat and hind quarters of all dark meat of approximately equal size.

d. Style 4 - Ready-To-Cook Cut-up - Confined to Class 1 or Class 5 chickens. Style 3 birds that are further processed by cutting into component parts and by packing in the same proportion in which they appear in the carcass; two wings, two drumsticks, two thighs, two breast halves, two back halves, 1 neck with giblets (gizzard, heart, and liver).

e. Style 5 - Ready-To-Cook Parts - Confined to Class 1 chickens. Individual packages of wings, legs (thigh and drumstick intact), thighs, drumsticks, breasts, backs, gizzards, hearts, and livers.

4. GRADE - grading will be considered in detail in the next unit. The DOD procures only N.S. Grade A and U.S. Grade B.

TURKEYS:

1. TYPES - generally the same as for chickens.

2. CLASSES - vary from chickens in that more of the divisions are according to size.

   a. Class I - Fryers-Roasters.

   b. Class II - Young Hens.

   c. Class III - Young Toms.

   d. Class IV - Yearling Hens.

   e. Class V - Yearling Toms.

   f. Class VI - Old Turkeys (hens and toms).

3. STYLES - correspond generally to Styles of chickens.

4. GRADES - correspond generally to Grades of chickens except that greater amounts of defects are permitted for turkeys because of their larger size.

POULTRY GRADING

When we are concerned with federal inspection, there are two terms that we must understand:

1. "U. S. Inspected for Wholesomeness" - this term means only that the product is acceptable from the standpoint of plant sanitation and product soundness.

2. "U. S. Grade ____" - this term means that the quality of the product has been examined in accordance with federal grade standards and has been placed in a certain quality category.

In plants having federal inspection, all birds must be "U. S. Inspected for Wholesomeness" but the plant has an option as to whether all, or none will be "U. S. Graded."

Our first concern in the grading of poultry is the document which prescribes the specific limitations, etc. for the various factors to be considered. This document is titled Regulations Governing the Grading and Inspection of Poultry and Edible Products Thereof and U. S. Classes, Standards, and Grades with Respect Thereto. (7CFR part 70) We commonly refer to this document as the "U. S. Standards". It is concerned primarily with the grading of poultry and with poultry plant sanitation.

Other documents which may modify the requirements for our particular needs are:

1. DPSC Clauses.

2. DOD Deviation Lists.

3. The individual purchase instruments.

In the charts summarizing the grade requirements, you will note that A, B, and C grades are shown. The Departments of Defense procures only Grades A and B.

Determining the quality of poultry may be compared with determing the quality of eggs. The "U. S. Standards" lists certain factors and then limitations for each of these factors. The factors considered are:

1. Conformation - This refers to the general outline or shape of the bird, and is based primarily on the skeletal structure.

2. Fleshing - Fleshing refers to the amount and distribution of flesh on the bird, particularly on the drumsticks, thighs, and breast. When determining this factor, keep in mind the age and species of the bird because the degree of fleshing will vary accordingly.

3. Fat covering - sufficient to mask the color of the flesh beneath [illegible] experienced graders are quite likely to be too harsh on this factor when grading young birds that have not yet added a good covering of fat.

4. Pinfeathers - Pinfeathers considered when grading poultry can be placed into two types: protruding and nonprotruding. Protruding pinfeathers are those which have penetrated through the skin, but have not necessarily formed a "brush". You will be able to insert your fingernail under the protruding ends of such pinfeathers. Nonprotruding pinfeathers are those which can be seen but which have not pushed their way through the outer layer skin. When grading dressed poultry, you must consider both the number and location these types of pinfeathers. A bird is considered free of protruding pinfeathers if has a generally clean appearance (especially on the breast); and if no more than an occasional protruding pinfeather is in evidence during a more careful examination.

5. Vestigial feathers - These are rudimentary structures. There are two types of vestigial (imperfectly developed) feathers; hair (which is easily removed by singeing) and down (small silky feathers with no web, lying between the main feather lines). Down is very common on ducks and geese, and is often seen on fryers. It is difficult to remove and when wet it clings to the skin and cannot be easily seen nor removed by singeing. All Grade A poultry must be free of vestigial feathers (both hair and down) and protruding and nonprotruding pinfeathers.

6. Cuts, tears, and missing skin - Cuts, tears, and missing skin detract from the appearance of the bird; permit the flesh to dry out when the bird is cooked (thus lowering the eating quality of the bird); and expose the flesh to dehydration in storage. The number and extent of these defect, permitted depend upon their location. If the defect are on the breast or legs, less tolerance is permitted because these are the highest priced parts. Shown tears are not allowed.

7. Discoloration - Discoloration factors, basically involve color and the type and size of discoloration. Certain varieties of chickens and turkeys have a normal bluish-green color and a brownish-black pigment, melanin, in the feather follicles on the abdominal area. Even such natural discoloration should be considered as part of the aggregate area of discoloration.

8. Bruises - Bruises of the skin may be distinguished from flesh bruises by moving the skin. Bruises must be removed before grading and the resulting cut is considered along with other cuts and tears. All discoloration defects must be considered in the aggregate to determine the total area involved. Thru discoloration on the breasts and legs are not as tolerable as those on other parts of the body.

9. Broken or disjointed bones and missing parts - the number of these defects allowed varies with the grade as indicated in the Table which appears later. These must be no related bruise or blood clot. There are some parts of the bird which may be removed without affecting the grade. These include the pygostyle (free part of the tail) and the tips of the wings. Carcasses which are to be used for cut-up styles may have had any number of parts removed for any reason. Cartilage which is separated from the breastbone is not considered to be a "disjointed or broken bone."

10. Freezer burn - Freezer burn is a discoloration of surface tissues resultant from dehydration whole in frozen storage. The effect on grade depends on the extent.

In determining the quality of a particular bird, the carcass must be judged on the basis of each of these factors. The overall quality assigned to it can then be no higher than the lowest of the individual quality factors. The grading factors for turkeys are practically the same as for chickens. A greater amount of defects is permitted for turkeys because of their larger size.

POULTRY INSPECTION

At this time, in referring to "inspection" we mean inspection other than Class 1 or Class 2. If follows then that we are speaking of two broad groupings of inspections.

1. Inspections incident to procurement - Classes 3, 4, and 8.

2. Surveillance inspections - Classes 5, 6, and 9.

In the first category, inspections incident to procurement, we are naturally inspecting for all terms of the contract. Our first step is to thoroughly study the purchase instrument to ascertain:

1. Exactly what products are being procured.

2. All documents which relate to the particular purchase - specifications, DPSC clauses, DOD deviation lists, etc.

CLASS 3 INSPECTIONS: Our determination here is "Are we getting the products that the purchase instrument calls for?" In making this determination we are concerned with the following:

1. Species - chickens, turkeys, ducks, etc.

2. Type - refers to state of refrigeration and duration of storage in the vendor's possession.

3. Class - age, sex.

4. Style - fabrication; i.e. whole, halved-split, quartered, cut-up, parts.

5. Grade - DOD buys only Grades A and B.

6. Condition - we are very critical here on procurement inspections; reject for slime, mold, greening, off-odors, extreme emaciation, tumors, anemia, freezer burn or poor workmanship (pin feathers, tears, cuts, dirt or fecal matter, remaining parts of viscera).

7. Packing and packaging.

8. Marking.

CLASS 4 INSPECTIONS: Since this inspection is also incident to procurement, we have the same concern as we do with Class 3 inspections. The only differences is that here insofar as Species, Type, Class, Style, and Grade are concerned we are doing a verification inspection only and are looking for evidence of fraud or of gross error on the Class 3 inspection and, of course, net weighing.

CLASS 8 INSPECTIONS: Here we are primarily doing a verification inspection with special interest on the source and on the wholesomeness of the product.

In the second category of inspections (surveillance inspections) we are dealing with birds that are already government-owned. Our concern then becomes one of maintaining the product in condition fit to be utilized as human food.

CLASS 5 INSPECTIONS:

1. Note condition and date of pack.

2. Normally products should be warehoused in such a manner that the oldest date of pack would be used first....condition may dictate otherwise.

CLASS 6 INSPECTIONS:

1. Note condition of birds, date of pack, and condition of packing and packaging materials.

2. Will the product be adequately protected during shipment? (Include cleanliness and temperature of the vehicle)

3. Will the date of pack allow keeping at the new destination until the product will be used?

CLASS 7 INSPECTIONS: The product is being issued for immediate use. At this time our only interest is whether or not the product is fit for human consumption.

CLASS 9 INSPECTIONS:

1. All products is storage should be inspected every 30 days in order to ascertain their current condition and their anticipated storage life. Routinely inspect 5%, inspect additional amounts on the basis of findings in that 5%.

2. Recommend immediate use if there are any findings which indicate the need therefor. These may include:

a. Freezer burn - due to dehydration; a not uncommon practice to correct freezer burn is to thaw birds in ice water; DO NOT ALLOW THIS as you are likely to contaminate all birds in the lot.

b. Slime and/or mold - can be washed off with salt water or soda water if it is not extensive.

c. Greening -

(1) This is not a health factor but is objectionable from an esthetic viewpoint; also called "green struck."

(2) Caused by chemical decomposition of hemoglobin and occurs in birds that have been improperly bled or cooled or were slaughtered shortly after feeding.

(3) Will probably require condemnation on the basis of appearance but you may be able to save some parts.

d. Decomposition of the liver and giblets - watch these parts closely as they have a maximum storage life of 9 to 10 months.

REPORTS, MISCELLANEOUS INFORMATION, AND REFERENCES

REPORTS: Inspections of poultry and poultry products will be reported on DD Form 1234, "Report of Inspection of Subsistence Products". Detailed instructions for preparation of this form can be found in Section 213.1 of the DPSC Manual.

INFORMATION TO BE INCLUDED IN NOTICES TO PROSPECTIVE SUPPLIES

1. Refer to Chapter XI, "Poultry and Related Products" of the DPSC Buyer's Guide.
2. The following information should always be included:
    - a. Kind - chickens, turkeys, ducks, etc.
    - b. Type - fresh chilled, frozen, etc.
    - c. Class - physical characteristics due to age and/or sex.
    - d. Individual weights - will vary with the method of serving.
    - e. Style - the way it is processed; whole, halved, quartered, etc.
    - f. Grade - quality based on fleshing, fat covering, and freedom from defects.
    - g. Other -
        - (1) Should require that the product delivered bear the inspection legend of the USDA.
        - (2) Point(s) of inspection.
        - (3) Point of acceptance.
        - (4) Date, time, and place of delivery.

REFERENCES:

1. The Anatomy of Domestic Animals, Sisson and Grossman; W. B. Sanders Company, Philadelphia, Pennsylvania.

2. Diseases of Poultry, Biester and Schwarte; The Iowa State College Press, Ames, Iowa.

3. Poultry Plant Sanitation; Institute of American Poultry Industries, 221 N. LaSalle, Chicago, Illinois.

4. Regulations Governing the Inspection of Poultry and Poultry Products (7 CFR Part 81); USDA.

5. Regulations Governing the Grading and Inspection of Poultry and Edible Products Thereof and the United States Classes, Standards, and Grades with Respect Thereto (7 CFR Part 70); USDA.

6. Poultry Products Inspection Regulation (9 CFR Part 381); USDA.

7. List of Plants Operating Under USDA Poultry and Egg Grading and Egg Products Inspection Programs; USDA (revised each June and December).

8. Poultry Grading Manual, Agriculture Handbook #31; USDA.

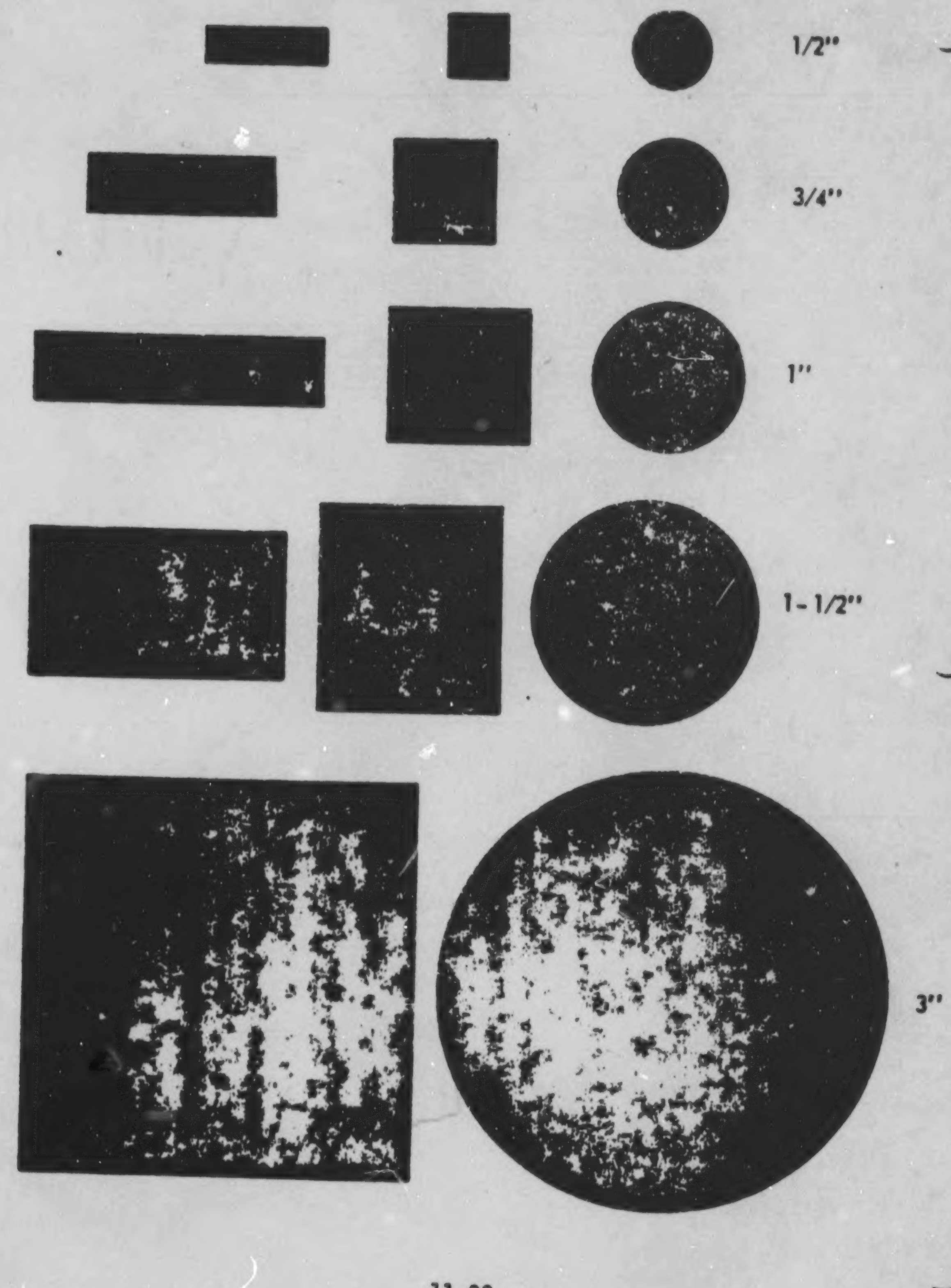
9. Examination and Evaluation of Poultry and Poultry Products; U. S. Department of Health, Education, and Welfare.

10. Poultry Inspection; American Public Health Association, Inc. 1015 Eighteenth Street, N. W.; Washington, D.C. 20036.

11. Current specifications as listed in the latest Index to Subsistence Specifications.

12. Film TF 1-8151, Poultry Processing Inspection; a 22 minute, 16mm motion picture in color and with sound, showing the various procedures involved in poultry processing.

Guide For Estimating The Relative Size of Discolorations



SUMMARY OF SPECIFICATIONS FOR STANDARDS OF QUALITY FOR INDIVIDUAL CARCASSES OF READY-TO-COOK POULTRY AND PARTS THEREFROM

(Minimum Requirements and Maximum Defects Permitted)

FACTOR		A QUALITY			B QUALITY			C QUALITY
CONFORMATION:		Normal			Moderate deformities			Abnormal
Breastbone		Slight curve or dent			Moderately dented, curved or crooked			Seriously curved or crooked
Back		Normal (except slight curve)			Moderately crooked			Seriously crooked
Legs and Wings		Normal			Moderately misshapen			Misshapen
FLESHING:		Well fleshed, moderately long, deep and rounded breast			Moderately fleshed, considering kind, class and part			Poorly fleshed
FAT COVERING:		Well covered--especially between heavy feather tracts on breast and considering kind, class and part			Sufficient fat on breast and legs to prevent distinct appearance of flesh through the skin			Lacking in fat covering over all parts of carcass
PINFEATHERS:								
Nonprotruding pins and hair		Free			Few scattered			Scattering
Protruding pins		Free			Free			Free
EXPOSED FLESH:[1]								
Carcass Weight								
Minimum	Maximum	Breast and Legs	Elsewhere	Part	Breast and Legs[2]	Elsewhere[2]	Part	
None	1 1/2 lbs.	None	3/4"	(Slight trim on edge)	3/4"	1 1/2"	(Moderate amount of the flesh normally covered	No Limit
Over 1 1/2 lbs.	6 lbs.	None	1 1/2"		1 1/2"	3"		
Over 6 lbs.	16 lbs.	None	2"		2"	4"		
Over 16 lbs.	None	None	3"		3"	5"		
DISCOLORATIONS:[3]								
None	1 1/2 lbs.	1/2"	1"	1/4"	1"	2"	1/2"	No Limit[4]
Over 1 1/2 lbs.	6 lbs.	1"	2"	1/4"	2"	3"	1"	
Over 6 lbs.	16 lbs.	1 1/2"	2 1/2"	1/2"	2 1/2"	4"	1 1/2"	
Over 16 lbs.	None	2"	3"	1/2"	3"	5"	1 1/2"	
Disjointed bones		1			2 disjointed and no broken or			No limit
Broken bones		None			1 disjointed and 1 nonprotruding broken			No limit
Missing parts		Wing tips and tail[5]			Wing tips, 2nd wing joint and tail			Wing tips, wings and tail
FREEZING DEFECTS: (When consumer packaged)		Slight darkening over the back and drumsticks. Few small 1/8" pockmarks for poultry weighing 6 lbs. or less and 1/4" pockmarks for poultry weighing more than 6 lbs. Occasional small areas showing layer of clear or pinkish ice.			Moderate dried areas not in excess of 1/2" in diameter. May lack brightness. Moderate areas showing layer of clear, pinkish or reddish colored ice.			Numerous pockmarks and large dried areas.

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[1] Total aggregate area of flesh exposed by all cuts and tears and missing skin.

[2] A carcass meeting the requirements of A quality for fleshing may be trimmed to remove skin and flesh defects, provided that no more than one-third of the flesh is exposed on any part and the meat yield is not appreciably affected.

[3] Flesh bruises and discolorations such as "blue back" are not permitted on breast and legs of A quality birds. Not more than one-half of total aggregate area of discolorations may be due to flesh bruises or "blue back" (when permitted), and skin bruises in any combination.

[4] No limit on size and number of areas of discoloration and flesh bruises if such areas do not render any part of the carcass unfit for food.

[5] In geese, the parts of the wing beyond the second joint may be removed, if removed at the joint and both wings are so treated.

108

STUDENT TEXT 3ABR90830-VII-2
3OBR992T-I-II-TO

DEPARTMENT OF VETERINARY MEDICINE

VETERINARY SPECIALIST

EGG INSPECTION

December 1974

1-4

SCHOOL OF HEALTH CARE SCIENCES, USAF
SHEPPARD AIR FORCE BASE, TEXAS

Designed For ATC Course Use

DO NOT USE ON THE JOB

Supplement to PT 3ABR90830-VII-3/
3OBR9921-1-II-10

Errata Sheet

PT 3ABR90830-VII-3/3OBR9921-1-II-10, Egg Inspection, is designed to be used in conjunction with ST 3ABR90830-VII-2/3OBR9921-1-II-10, Egg Inspection. A recent revision of the ST resulted in page numbers referenced in the PT being incorrect. To rectify this problem, please make the following pen-and-ink changes in those copies of the PT dated November 1974.

1-4

Page Number	Line Number	Change to be Made
4	11	"page 4" to "page 5"
4	15	"page 7-28" to "page 30"
4	15	"paragraph 1" to "Section Q paragraph 1"
7	6	"page 7-18" to "page 19"
8	4	"page 7-14" to "page 15"
9	4	"page 7-15" to "page 17"
9	9	"page 7-31" to "page 34"
11	11	"page 7-17" to "page 19"
12	9	"page 7-20" to "page 22"
12	22	"page 7-18" to "page 20"
17	5	"page 7-17" to "page 18"
17	6	"page 7-13" to "page 13"
19	5	"page 7-16" to "page 18"
20	8	"page 7-17" to "page 18"
21	10	"page 7-17" to "page 18"
22	5	"page 7-17" to "page 19"
23	10	"page 7-13" to "page 14"
24	8	"page 7-17" to "page 18"
25	7	"pages 7-15 and 7-16" to "page 17"
27	10	"page 7-2" to "page 2"
27	11	"page 7-6" to "page 6"
27	12	"page 7-34" to "page 37"
28	1	"pages 7-6 thru 7-10" to "pages 6 thru 10"
28	3	"page 7-32" to "page 35"
28	4	"pages 7-10 thru 7-13" to "pages 10 thru 13"
29	8	"page 7-13" to "page 14"
29	10	"pages 7-19 and 7-20" to "page 21"
29	12	"page 7-20" to "page 21"
30	14	"pages 7-20 and 7-21" to "pages 22 and 23"
33	1	"pages 7-21 and 7-22" to "pages 23 and 24"
34	4	"page 12-19" to "page 21"
34	8	"page 7-21" to "page 23"

Department of Veterinary Medicine
School of Health Care Sciences, USAF
Sheppard Air Force Base, Texas

ST 3ABR90830-VII-2
3OBR9921-1-II-10
December 1974

EGG INSPECTION

OBJECTIVE

The student will be able to identify the grading factors of individual eggs and the procedures involved in reading contracts, specifications, and the Tables of Allowable Variations. This will enable the student to determine contract compliance and recommend proper disposition of shell eggs.

INTRODUCTION

This chapter deals with the concepts involved with the formation and composition of the egg and the quality factors of shell eggs. The student must understand the quality factors in order to determine the USDA quality grades. The Tables of Allowable Variations will also be dealt with in this chapter, and by combining these tables with the quality grades, the student will be able to complete a DD Form 1237, the Egg Inspection Report.

SECTION A - INTRODUCTION TO SHELL EGG INSPECTION

1. The only egg purchased by the DOD is that of the domestic chicken hen, therefore, for our purposes we consider the word "egg" as referring to chicken eggs unless otherwise stated.

2. NUTRITIVE VALUE OF EGGS

a. Pound for pound, the egg ranks second in the US as the most abundantly used food, surpassed only by milk.

b. Eggs are an excellent food for body maintenance; they promote growth, lactation, and reproduction, all of which make vigorous demands and are likely to uncover deficiencies in a food.

c. Eggs are composed primarily of proteins and fats, with some carbohydrates present.

d. They supply a wide variety of minerals, some in significant amounts,

e. They contain nearly all of the known vitamins; they are an excellent source of Vitamins A and D; Vitamin C is the only known vitamin of which eggs are a poor source.

3. ECONOMIC VALUE OF EGGS IN THE AIR FORCE MENU

a. In one recent year, the per capita consumption of eggs in the US was 378. The retail price of eggs during this same year averaged 56.5¢ per dozen, amounting to $17.80 per person.

b. The Master Menu for the month of July 1971 called for 6,1496 dozen (74) eggs per man for that month.

This supersedes SG 3ABR90830-X-2, May 1973

4. RESPONSIBILITIES OF THE AF VETERINARY SERVICE IN EGG INSPECTIONS

a. Destination inspection primarily:

(1) To protect the health of military personnel.

(2) To protect the financial interest of the Govenment - a highly perishable product requiring efficient inspection to assure purchase of high quality eggs and then to assure that they are properly handled and stored.

b. Occasionally will include procurement inspection, especially in overseas areas.

c. Surveillance inspection.

d. Giving advice relative to local procurement of eggs.

SECTION B - FORMATION OF THE EGG

The reproductive system of the hen can be divided into two major parts, the ovary and the oviduct.

1. THE OVARY

a. Most female animals possess both a right and left functioning ovary; in the hen, the right ovary and oviduct are normally nonproductive.

b. Located in the upper part of the body cavity, attached very close to the backbone opposite the last two ribs.

c. Fully formed although very small when the chick is hatched; contains from 500 to over 3,000 minute yolks, each within its own sac or follicle.

d. In a hen in active production it will resemble a cluster of grapes with the follicles in various stages of maturity and varying in size from pinpoint to full yolk size.

e. Stages of ovum (yolk) formation.

(1) The First Stage

(a) Concluded before hatching.

(b) Begins about the 12th hour of incubation and continues for about 15 days.

(c) Results in the formation of the reproductive tissues in the developing embryo.

(2) Second Stage

(a) Begins upon completion of the first stage and continues almost until sexual maturity.

(b) Follicles develop about the immature yolks.

(c) This stage ends with the developing yolk about 3 mm in diameter.

(3) Third Stage

(a) Begins 8 to 10 days before ovulation.

(b) Controlled by follicle stimulating hormone (FSH) of the pituitary gland.

(c) The vitelline membrane (or yolk membrane) forms between the yolk and the follicle. Yolk fluid, yellow in color due to fat solubel dyes, is added inside the membrane. Variations in color may be noted due to other dyes present in feed stuffs.

(d) During this period the ovary secretes hormones which stimulate the oviduct and prepare it to receive the yolk.

f. Ovulation

(1) The release of a mature ovum (yolk) from its follicle.

(2) Follicles normally rupture along the stigma or suture line which is largely devoid of blood vessels.

(3) Rupture of blood vessels at time of ovulation produces blood spots on the surface of the yolk or blood in the white; rupture of blood vessels prior to ovulation results in meat spots.

2. THE OVIDUCT - Carries the ovum from the ovary to the outside of the chicken's body and adds the white and shell as the passage progresses.

a. Infundibulum (funnel)

(1) About 3" - 4" long and opens directly into the body cavity adjacent to the ovary.

(2) Becomes very active at time of ovulation, grasps the released ovum and starts it through the oviduct.

(3) May grasp pieces of other material resulting in their presence inside the shell.

(4) Serves as a reservoir for sperm and is the place where fertilization occurs.

(5) Stay in this area is approximately 15 minutes.

b. The magnum

(1) Approximately 15" long.

(2) Thick white is added here.

(3) Stay is about 3 hours.

c. Isthmus

(1) Constricted portion of oviduct about 4" long.

(2) The two shell membranes and some water and mineral salts are added.

(3) Passage takes about 1 1/4 hours.

d. Uterus

(1) A heavy-walled part of the oviduct approximately 4" long.

(2) Final complement of white and minerals are added through the shell membranes and then the shell is added.

(3) Stay here is about 21 hours.

e. Vagina

(1) The terminal part of the oviduct proper, about 2" in length.

(2) Most of the cuticle is added here.

(3) Passage is rapid, taking only a few minutes.

f. Cloaca

(1) A common part of the reproductive tract, digestive tract, and urinary tract.

(2) Receives the egg and holds it until time of laying.

g. Vent - the opening from the cloaca to the outside of the body.

SECTION C - THE FRESH EGG

1. DEFINITION - fresh eggs are eggs of recent production and having the characteristics of newly laid eggs. They shall not have been held in excess of 30 days and shall have been handled under temperature and humidity conditions which will maintain their quality.

2. STRUCTURE OF THE EGG

a. Yolk - the "yellow" central portion of the egg. The color is due to fat-soluble pigments ingested by the chicken, absorbed into the blood stream, and then deposited in the developing yolk. The yolk constitutes approximately 31 percent of the weight of the egg.

(1) Germinal disc - the group of cells from which the embryo would form if the egg was fertilized.

(2) Latebra - a streak of "white" yolk extending from the germinal disc to the center of the yolk. It was deposited by migration of the germinal disc to the outer edge of the developing yolk.

(3) Concentric "light" and "dark" or "white" and "yellow" rings of yolk material.

(4) Vitelline (yolk) membrane.

b. White - several layers of albumin making up approximately 58 percent of the weight of the egg. A homogenous gel made up of mucin secreted as fibers. The spiral movement of the developing egg as it passes down the oviduct causes these fibers to draw together, forming the chalaziferous layer and the chalazae (pronounced Kah-lay'za).

(1) Chalaziferous layer.

(a) A very thin tough layer of albumin surrounding the yolk and continuous with the chalazae.

(b) Surrounds the vitelline membrane and lends support to it.

(c) The chalazae allow the yolk to turn so as to keep the germinal disc uppermost and closest to the warmth of the hen's body in case it had been fertilized.

(2) Inner thin layer - results from a partial liquefaction of the dense gel and is wrung from the chalaziferous layer which it surrounds.

(3) Firm or thick layer.

(a) Provides an envelope or jacket which hold the inner thin white and the yolk.

(b) Adheres to the inner shell membrane at each end of the egg.

(4) Outer thin layer.

(a) Lies just inside the inner shell membrane except at the areas where the thick layer is attached.

(b) Has resulted partially from a "pushing outward" of liquefaction products from the thicker layer and partially from secretion by the uterus and passage by osmosis through the shell membranes.

(c) Further dilutes the thick white and plumps the shell membranes.

c. The Shell Membranes - two (inner and outer) thin but tough membranes which protect the egg from outside contamination. At the time of laying the two membranes are in almost total contact but as the egg cools the liquid contents shrink and air comes in through the porous shell, forming a space between the two. This space is normally at the large end of the egg and is called the air cell.

d. The Shell.

(1) Composed of 94 percent calcium carbonate, 1 percent magnesium carbonate, 1 percent calcium phosphate and 4 percent organic matter.

(2) Deposited in two layers.

(a) Inner or mammillary layer - made up of knob-like masses of crystals firmly attached to the outer shell membrane. Minute spaces between these masses of crystals comprise an extensive ventilation system which allows gaseous exchange.

(b) The outer or spongy layer - a firm and dense layer containing thousands of minute pores and laid down on top of the inner layer.

(c) Pigment - if present, pigment is laid down in the spongy layer and is derived from hemoglobin of red blood cells. The ground pigment is deposited during shell formation and is very uniform, but that added later may be in spots, streaks, blotches, or flecks.

3. BROKEN-OUT APPEARANCE OF A FRESH EGG OF TOP QUALITY

a. Yolk should be high and rounded and uniform in color, ranging from pale yellow to dark orange.

b. Both the thick white and the thin white should be colorless.

c. Thick white should be firm and should closely surround the yolk when on a flat surface.

4. CANDLED APPEARANCE OF A FRESH EGG OF TOP QUALITY

a. Yolk shadow outline will be only slightly defined. Due to the thickness of the white keeping the yolk centered and preventing it from moving close to the shell where it would be more distinct.

b. Air cell will be 3/16" or less in depth (AA or A quality).

5. CHANGES IN EGGS DUE TO AGING

a. Gaseous exchange through the porous shell and evaporation of water shrinks the inner shell membrane and results in an enlargement of the air cell.

b. With the loss of water, carbon dioxide is also lost causing an increase in alkalinity which in turn causes further deterioration and increases the rate of liquefaction of the thick white.

c. The white becomes thinner (more watery), the yolk flattens, and yolk movement increases. All of these changes can be noted by candling.

SECTION D - QUALITY DETERMINATION OF EDIBLE EGGS

1. GENERAL

a. A number of methods have been used to determine the quality of eggs. At the present time, the most used method is candling which consists of viewing the contents of the egg by way of a strong light shining through the shell from the rear.

b. Quality - the inherent properties of a product which determine its degree of excellence.

c. Quality Factors - those various specific points which relate to quality as a total expression.

d. Grades - specific combinations of the various qualities in lots of quantities. Grades incorporate tolerances for small percentages of eggs of a lower quality than that comprising the major part of the grade. These tolerances are to allow for:

(1) Errors in judgment.

(2) Differences in interpretation.

(3) Normal deterioration in quality which occurs between the time of grading and the time of sale to the consumer.

e. The quality of freshly laid eggs varies with:

(1) The period of the laying cycle.

(2) The individual hen laying the egg.

(3) The season of the year.

(4) Food given the hen.

2. QUALITY FACTORS FOR SHELL EGGS - a summary of these factors may be found in tabular form at the end of this chapter.

a. Exterior Quality Factors - those apparent from external observation.

(1) Shell shape and texture - the normal egg has an oval shape with one end larger than the other and tapering toward the smaller end. Eggs that are unusual in shape are placed in lower quality groups because their shells are usually weaker than normal shells and the danger of breakage enroute to the consumer lowers the utility value.

(a) Practically normal - eggs which are very close to the ideal shape. "Body checks" will be permitted if they have no protruding ridges ("AA" and "A" quality).

(b) Slightly abnormal - may be somewhat unusual in shape, may have definite but not pronounced ridges, and/or may have slight but not pronounced rough or thin areas ("B" quality).

(c) Abnormal - those eggs whose shape might cause them to protrude too high in their containers, are decidedly faulty in texture or strength, or have pronounced ridges, thin spots or rough areas ("C" quality).

(2) Shell soundness

(a) Sound-shelled - an egg whose shell is unbroken ("AA," "B," "C," and "Dirty" quality eggs).

(b) Checked - an egg whose shell is cracked but whose shell membrane is intact ("Check" quality).

(c) Body checks - eggs whose shells were cracked prior to leaving the uterus and were then repaired by an additional depost of shell over the cracked area. Will generally result in a ridged area but is considered in quality determination only to the extent that the ridges predisposed to damage.

(d) Leakers.

1 Eggs whose shell and shell membranes are broken and whose contents are free to exude or leak from the shell.

2 Those eggs not actually leaking but with an area of shell larger than 1/4" square missing even though the shell membrane is intact.

3 Smashed - eggs broken so badly that they cannot be removed from their containter.

(3) Shell cleanliness

(a) Clean - clean or with only very small specks or stains and if they are not of sufficient number or intensity to detract from the generally clean appearance of the egg. Traces of processing oil on an otherwise clean egg will not be cause to assign it a lower quality ("AA" and "A" quality).

(b) Slightly stained - a barely detectable stain covering not more than 1/32 of the shell surface if localized or not more than 1/16 of the shell surface if scattered ("B" quality).

(c) Moderately stained - readily noticeable but not prominent stains covering not more than 1/4 of the shell surface ("C" quality).

(d) Dirty - eggs with any trace of adhering dirt or with stains covering more than 1/4 of the shell surface ("Dirty" quality).

(e) Mottled shells - this refers to small areas of the shell which appear to be more translucent. These areas are due to unequal distribution of the moisture the shell and are not considered in determining quality.

(f) Shell color is not a factor in quality determination.

b. Interior Quality Factors - those which have to do with the contents of the shell.

(1) The air cell

(a) Depth - distance form the top of the air cell to its bottom when the egg is held with the air cell upward.

1 "AA" quality - not more than 1/8".

2 "A" quality - not more than 3/16".

3 "B" quality - not more than 3/8".

4 "C" quality - more than 3/8".

(b) Movement

1 Practically regular - not more than 1/4" ("AA" and "A" quality).

2 Free or bubbly - a free air cell will move about in the egg, staying in its uppermost point; a bubbly air cell is one in which a bubble has formed as a result of a tear in the inner shell membrane ("B" and "C" quality).

(2) The yolk

(a) Distinctness of yolk shadow outline

1 Outline slightly defined - outline is indistinctly indicated and appears to blend into the surrounding white when twirled ("AA" quality).

2 Outline fairly well defined - outline discernible but not clearly defined when twirled ("A" quality).

3 Outline well defined - outlined definite and distinct as the egg is twirled ("B" quality).

4 Outline plainly visible - outline produces a dark shadow when twirled ("C" quality).

(b) Size and shape - mentioned only in connection with "B" and "C" quality where these factors become apparent.

1 Slightly enlarged and flattened - the yolk membranes and tissues have become slightly weakened ("B" quality).

2 Enlarged and flattened - yolk membranes and tissues have weakened and moisture has been absorbed from the white ("C" quality).

(c) Defects and germ development - difficult to determine accurately by candling if the white is of high viscosity.

1 Practically free from defects - no germ development but may show other very slight surface defects ("AA" and "A" quality).

2 Definite but not serious defects - may show definite spots but only slight indications of germ development or of other pronounced or serious defects ("B" quality).

3 Other serious defects - well developed spots or areas and/or other serious defects (i.e. olive yolk) but which do not render the egg inedible ("C" quality).

4 Clearly visible germ development - germ spot has progressed to the point where it is clearly visible as a circular area or spot ("C" quality if no blood is evident; "Loss" if blood is evident).

(3) The White

(a) Condition or thickness - determined in candling by noting intensity of yolk shadow and movement.

1 Firm - sufficiently thick to allow only a slightly defined yolk outline ("AA" quality).

2 Reasonably firm - allows sufficient yolk movement to get a fairly well defined yolk outline ("A" quality).

3 Slightly weak - permits quite free yolk movement giving a well defined yolk outline ("B" quality).

4 Weak and watery - allows free yolk movement with the outline appearing plainly visible ("C" quality).

(b) Clarity

1 Clear - free from discoloration or foreign bodies; do not confuse prominent chalazae with foreign bodies ("AA," "A," and "B" quality).

2 Small blood clots or spots - "C" quality if not larger than 1/8" in aggregate diameter; "Loss" if larger than 1/8" in aggregate diameter or with diffusions of blood into the white.

3. OVERALL QUALITY OF INDIVIDUAL EGGS - the overall quality assigned to an individual egg can be not higher than that of the lowest of the individual quality factors noted.

4. ORDER OF ACCEPTABILITY OF INDIVIDUAL EGGS

"AA"

"A" Table Eggs

"B"

"C"	
"Dirty"	Tolerance or Cooking Eggs
"Check"	
"Leakers"	Inedible Eggs (Except for Meat Spots and Blood Spots)
"Loss"	

SECTION E - ABNORMAL EGGS

1. GENERAL - when an egg is laid, the shell is intact and is coated with the cuticle which seals the pores. If the shell beomes damaged or if the cuticle is removed, this much of the natural defense of the egg is lost.

2. ABNORMALITIES DUE TO FOREIGN BODIES - any object moving up the reproductive tract until it encounters a descending egg being formed will be encased in the shell along with the egg materials.

3. ABNORMALITIES DUE TO REPRODUCTIVE TRACT MALFUNCTION

a. Double Yolks

(1) Both yolks released at the same time or one held in the body cavity and picked up along with the other one.

(2) "C" quality.

b. Egg Within an Egg

(1) Due to reverse peristalsis of the reproductive tract so that a fully formed egg meets a descending yolk and is incorporated within its shell.

(2) "Loss."

c. Yolkless Eggs

(1) Due either to failure of a yolk to be released or to some particle of ovarian or oviduct tissue stimulating secretion of white and shell.

(2) "Loss."

d. Blood Spots

(1) Due to release of blood onto yolk at time of ovulation.

(2) Remains red in color (do not confuse with blood rots or blood islands).

(3) "C" quality if aggregate diameter is 1/8" or less; "loss" (edible) if aggregate diameter is more than 1/8".

e. Meat Spots

(1) Due to bleeding from follicular vessels prior to ovulation and subsequent change in color form red to various shades of reddish brown, brown, or gray.

(2) "C" quality if aggregate diameter is 1/8" or less; "Loss" (edible) if aggregate diameter is greater than 1/8".

f. Blood Rot or Bloody White

(1) Due to massive hemorrhage of follicular vessels resulting in much blood throughout the white.

(2) "Loss."

g. Soft-Shelled Eggs

(1) Eggs laid prematurely with insufficient time in the uterus for adequate shell development.

(2) "Loss."

h. Thin-Shelled Eggs

(1) May be due to dietary deficiency, heredity or disease.

(2) "Loss."

i. Glassy-Shelled and Chalky-Shelled Eggs

(1) Due to malfunction of the uterus.

(2) Are less porous and will not hatch if fertilized.

(3) "Loss."

j. Off-Colored Yolks

(1) Due to substances in feed.

(2) "C" quality or "Loss," depending on severity.

k. Off-Flavored Yolks

(1) Due to disease or to feed flavors.

(2) May also be due to improper storage.

(3) "Loss."

4. ABNORMALITIES DUE TO EMBRYONIC DEVELOPMENT

a. Blood Islands

(1) Due to improper cooling of fertile eggs.

(2) Small areas of blood develop around the germinal disc.

(3) "Loss."

b. Blood Rings

  (1) Indicate the presence of a dead undeveloped chick embryo.

  (2) Results from breakdown of vascular system connecting the blood islands.

  (3) "Loss."

c. Visible Embryonic Development

  (1) Due to prolonged exposure of the egg to warmth; embryo development will progress at temperatures as low as 65 to 68 degrees F.

  (2) "C" quality if no blood is present; "Loss" if blood is present.

5. ABNORMALITIES DUE TO INVASION OF MICROORGANISMS

a. All classed as "Loss."

b. First Stage

  (1) White Rot

    (a) Yolk movement sluggish when candled.

    (b) Yolk not altered, but white is much thicker than usual.

  (2) Yellow Rot

    (a) First appears as heavy mottling on the yolk.

    (b) Later there is a definite crusting on the surface of the yolk.

  (3) Green Whites

    (a) When candled, they appear normal in all respects except color.

    (b) Whites has a definite green cast.

    (c) Due to organisms of the Pseudomonas group.

  (4) Sour Rots

    (a) White is very thin and the yolk is rubbery and tends to float like a cork.

    (b) Found mostly in storage or washed eggs.

c. Second Stage

  (1) Mixed Rot

    (a) Breakdown of the vitelline membrane allows the yolk and white to mix.

    (b) When candled, they show alternating ripples of light and dark shadow throughout the entire egg.

(2) Red Rot

(a) Yolk has a pronounced reddish tint.

(b) White may be completely liquefied and have patches of rusty to deep red color.

(c) Vitelline membrane is thickened and encrusted with white.

d. Third Stage - Black Rot

(1) May be totally opaque when candled, except for the air cell.

(2) White is completely liquefied and has a pronounced odor of hydrogen sulfide.

(3) Yolk becomes hard and black.

6. OTHER MISCELLANEOUS ABNORMALITIES AND LOSS CONDITIONS

a. Moldy Eggs

(1) Common in storage eggs.

(2) Depends on temperature and humidity, especially the latter.

(3) "Loss" whether on exterior or interior.

b. Stuck Yolks

(1) Yolk membrane attached to interior shell membrane.

(2) May see a dark spot at the point of attachment when candled.

(3) Generally occurs in older eggs held in one position for lengthy periods.

(4) "Loss."

c. Shortage

(1) A missing egg.

(2) "Loss."

d. Smashed

(1) An egg so badly damaged that it cannot be removed from its container in an entire condition.

(2) Classed as a "Leaker" (Page 213, 2 DPSC Handbook, 15 July 69, Block 23, Section h).

SECTION F - SAMPLE SIZE AND SELECTION

1. CLASS 3 (PRIOR TO PURCHASE) INSPECTIONS

a. Military personnel will not usually perform Class 3 inspections on shell eggs.

(1) Origin inspection is usually accomplished and certified by the USDA (always required on shipments of over 6,000 dozen). See Section 3a of DPSC Article 137A-1.

(2) The vendor may furnish a certificate stating that the shipment meets the grade and contract requirements (sometimes allowed by contract on shipments of 6,000 dozen or less). See Section 3B, DPSC Article 137A-1.

b. If origin inspection is performed by the military, selection of samples is performed in the same manner as for destination inspection except that the cases must be marked and secured and identified as THE lot to be offered (not just A lot or ANY lot).

2. MIXED GROUPS - if a group of eggs presented for inspection consists of mixed grades and/or sizes, each grade and size will be considered as a totally separate lot.

3. SELECTION OF SAMPLE CASES

a. Sample cases should be selected at random and should be slected from throughout the lot in order to be representative.

b. No set pattern of selection should be used.

c. Sample cases should be marked for identification (NOT with the DOD stamp if they are not Government property).

4. MINIMUM SAMPLE SIZE - from Section 56.4(2) of Regulations Governing the Grading of Shell Eggs and United States Standards, Grades, and Weight Classes for Shell Eggs (For destination sample size when PO Specifies "limited verification," consult Sec 213.4, DPSC Op. Man.).

Cases in lot	No. of sample cases
1	1
1-10	2
11-25	3
26-50	4
51-100	5
101-200	8
201-300	11
301-400	13
401-500	14
501-600	16

For each additional 50 cases or fraction thereof, selct one additional sample case.

5. SELECTION OF INDIVIDUAL EGGS FOR QUALITY DETERMINATION

a. From each sample case, 100 eggs from one side of the case will be examined.

b. Different layers should be utilized in selcting the 100 eggs to be examined (1-2-3, 2-3-4, 3-4-5, 1-2-4, 1-3-5, etc.).

c. Odd eggs (to complete the 100 needed) selected from a layer should always come from a layer should always come from the same location in the layer. This eliminates any possible argument as to whether certain individual eggs (dirties, checks, leakers, etc.) are to be accepted for grading as part of the sample or whether they will be purposely omitted from the sample.

SECTION G - LOT-GRADE DETERMINATION

1. GENERAL

a. "Quality" vs. "Grade"

(1) In referring to the degree of excellence of an individual egg, we use the term "quality."

(2) When we group a number of eggs having the same quality, the result is a "lot" of eggs having a particular "grade."

b. Lot - any quantity of two or more eggs (Sec. 56-215, U.S. Standards).

c. Tolerance

(1) A certain percentage of eggs showing lower quality allowed in any particular grade to make up for:

(a) Human error

(b) Variation in subjective interpretation.

(c) The material loss in quality that may occur between the initial grading and the consumer.

(2) "Tolerance Eggs" in a given "grade" are those eggs which are below "B quality."

2. GRADING SYSTEMS

a. Consumer Grades

(1) Used primarily with eggs intended for retail sale.

(2) No inedible eggs are permitted.

(3) DOD procurement is rare, possibly for hospital use or for resale

(4) Requirements are listed in Sec. 56-216 through 56.218 of U.S. Standard.

b. Wholesale Grades

(1) System intended primarily for use in wholesale channels of trade.

(2) Different from consumer grades in that a small percentage of inedible eggs is allowed.

(3) DOD procures no eggs under this grading system at this time.

(4) Requirements are listed in Secs. 56.226 through 56.228 of U.S. Standards.

c. Procurement grades:

(1) Used primarily for institutional procurements and is used extensively by governmental and private institutions.

(2) Incorporates tolerances for small percentages of eggs below the requirement for the lot; this tolerance includes some inedible eggs.

(3) Most DOD procurement is based on this system.

(4) Requirements are listed in Secs. 56.221 through 56.223 of U.S. Standards.

3. EGG QUALITY REQUIREMENTS FOR PROCUREMENT GRADES

a. Lot Average Requirements:

PROCUREMENT GRADE	MIN % A's	MIN % A's & B's	MAX % TOLERANCE*
I	80%	95%	5%
II	60%	90%	10%
III	40%	88.3%	11.7%
IV	20%	88.3%	11.7%

*Includes special consideration as discussed in Section 9 of this manual.

b. Individual Case Allowances:

PROCUREMENT GRADE	MINIMUM % A's*		MAX % TOLERANCE
	ANY NO. OF CASES	1 CASE IN 10**	
I	75%	70%	10%
II	55%	50%	15%
III	35%	30%	18%
IV	15%	10%	18%

*Par. 56.222 of U.S. Standards

**Applies only when the lot consists of 200 cases or more.

c. Individual contracts may be written when call for variations from the figures given above. We must always read the contract closely because it is final authority.

SECTION 4 - WEIGHT CLASSES FOR SHELL EGGS

1. WEIGHT CLASSES FOR PROCUREMENT GRADES - from Section 56.223 of U.S. Standards and Section 1.2.3.1 of Fed. Spec. (See chart at end of this chapter)

2. WEIGHT CLASSES FOR CONSUMER GRADES may be found in Section 56.218 of U.S. Standards.

3. DETERMINING CASE NET WEIGHT

   a. Weigh all fillers, flats, and eggs from one end of the sample case, round the figure downward to the closest 1/4 lb. and express as a decimal.

   b. Multiply this weight by 2.

   c. Subtract the tare weight.

      (1) 3 1/2 lb. for a 30-dozen case using 6 flats and 5 filters.

      (2) 2 lb. for a 30-dozen case with six 30-egg filler-flats.

      (3) For other than 30-dozen cases (or for cases with other than 6 flats and 5 filler or six 30-egg filler-flats) establish your own tare weight by weighing no less than 30 sets of fillers and flats or filler-flats.

      (4) Cartons vary in weight so a tare must be established for each lot by weighing no less than 15 empty cartons.

4. DETERMINING CASE NET WEIGHT (ALTERNATE METHOD)

   a. Remove all eggs from 2 cases.

   b. Obtain average tare (case and packing material) for the 2 cases.

   c. Obtain gross weight of each sample case.

   d. Determine net weight of each sample case by subtracting tare from gross.

   e. This method may NOT be used for wooden cases.

5. CASE NET WEIGHTS FOR OTHER THAN 30-DOZEN CASES - case net weights listed in the table above are for cases containing 30 dozen eggs. If you receive cases with other amounts, you may convert the case net weights of these cases as follows:

   a. For 16-dozen cases - multiply case net weight by 1.875.

   b. For 20-dozen cases - multiply case net weight by 1.5.

   c. For 24-dozen cases - multiply case net weight by 1.25.

   d. For 25-dozen cases - multiply case net weight by 1.2.

6. INDIVIDUAL UNDERWEIGHT EGGS

   a. Allowances are listed in Table 12-3 at the end of this chapter.

   b. This is not a "quality;" a particular egg may be underweight and still be an "A quality" egg.

SECTION I - OTHER CONSIDERATIONS IN SHELL EGG INSPECTION

1. ORIGIN INSPECTION REPORTS:

a. Section 3 of DPSC Article 137 A-1 REQUIRES that certificates from the USDA and/or contractor (as applicable) as to lot grade and other contract requirements MUST accompany the shipment or it will not be accepted at destination (this clause or may not be applicable on overseas shipments).

b. Receipt of government-owned eggs - note origin (Class 6) inspector's report here for information which might indicate a need for special handling (i.e. damaged shipments, older eggs, etc.).

2. TRANSIT TEMPERATURES

a. Determine in the same manner as for any other product. Place thermometer where it will not be influenced by air currents from the door or around blowers. Be sure to allow ample time for accurate temperature determination.

b. Note smashed or torn cases, wet cases, off-odors, etc.

c. If damage is noted that may have occurred while in transit, arrange a joint inspection with the carrier's representative within 24 hours and immediately notify DPSC.

d. For contracts of 400 cases or more, the eggs must be loaded in a vehicle precooled to no higher than 50° F. (Sec. 5b, DPSC Spec. [illegible] Commodity Clause 104b).

3. DAMAGE IN TRANSIT

a. Inspection accomplished as vehicle is opened and as cases are off-loaded.

4. EGG INTERNAL TEMPERATURE

a. Method of Determining:

(1) Insert dial thermometer into an egg located near the center of the third layer in each sample case.

(2) Record high and low temperatures noted and the average of all those checked.

b. Requirements - from Section 3.3.1.1 of Fed. Spec. C-E-271J, as amended by DOD Deviation List.

(1) The egg shall not be frozen at any time.

(2) At time of delivery, the fresh eggs shall have a case average internal egg temperature not higher than 60° F. with no individual case having an internal egg temperature exceeding 65° F.

(3) Allowable Variation Limits in DPSC handbook make no allowance over the requirement for internal temperatures.

VARIATION IN QUANTITY

a. Contract quantities of less than 9,000 dozen (300 30-dozen cases) will be accepted with a [illegible] variation in quantity.

b. Contract quantities of 9,000 dozen or more will be accepted with a 5 percent variation in quantity.

6. PACKING, PACKAGING, AND MARKING REQUIREMENTS - check the purchase instrument and related documents for specific requirements here.

a. B Level Pack - normally used on domestic procurement of eggs for overseas shipment; additional packing material has been added to give greater protection against damage; often referred to as "Export Pack."

b. C Level Pack - practically all eggs procured for domestic use will be of C Level Pack; often referred to as "Domestic Pack."

7. OFFICIAL DOCUMENTS PERTAINING TO EGG INSPECTION

a. The individual purchase instrument - this is the final authority in ALL cases and must be closely examined for EACH shipment.

b. "Regulations Governing the Grading of Shell Eggs and United States Standards, Grades, and Weight Classes for Shell Eggs" - commonly referred to as "U.S. Standards."

c. Federal Specification C-E-27J, "Eggs, Shell."

d. DOD Deviation List to Fed. Spec. C-E-271J.

e. DPSC Special Commodity Clauses for Eggs (104)

f. DPSC Article 137-~~-~~C

8. CONDITIONS OF EGGS - from Fed. Spec. C-E-271J as amended by DOD Deviation List.

a. Condition 1, Fresh - eggs of recent production and having the characteristics of newly laid eggs. Shall not have been held in excess of 30 days and shall have been handled under temperature and humidity conditions which will maintain their quality.

b. Condition 2, Shell, Protected Fresh - fresh eggs which have been properly treated with oils or other processing fluids to afford protection to the quality of the egg and which do not impart color, flavor or odor to the egg.

9. CLEANING OF EGGS - cleaned eggs may be accepted provided the eggs are cleaned as prescribed in USDA Regulations governing the Grading of Shell Eggs (Fed. Spec. C-E-271J as amended by DOD Deviation List).

10. TOLERANCE EGGS (REQUIREMENTS)

a. Maximum of 4.5 percent checks.

b. Maximum of 0.5 percent dirties.

c. Maximum of 0.5 percent leakers and smashed.

d. Maximum of 0.5 percent loss (including shortage); of the loss, not more than 0.2 percent shall be for other than Large Meat Spots or Large Blood Spots (inedible).

e. Even though the above figures are "requirements," after you have computed all of the factors for your shipment you must then check subsection 213.4 pages 7-10 of the [illegible] Handbook to determine the acceptable allowable variation limits for each factor. These allowable limits change as the sample sizes change.

11. DESTINATION INSPECTION - will be for identity, count, and condition, and for verification of the origin grade and other contract requirements.

SECTION J - EGG INSPECTION EQUIPMENT AND TECHNIQUES

1. EGG INSPECTION SET, VETERINARY, FSN 6545-805-8700

a. Scale, Beam indicating, Egg Weighing

(1) A balance-type scale for determining weights of individual eggs.

(2) Calibrating

(a) Move wire lock to side.

(b) Put 20 oz. or 23 oz. brass weight into egg cup.

(c) Put the movable counter-weight on the egg cup side of the fulcrum for 20 oz. eggs or on the opposite side for 23 oz. eggs.

(d) Adjust the scale by screwing the knob-like counter-weight on the tip of the beam either in or out.

(3) Use

(a) Move wire lock to side.

(b) Calibrate.

(c) Adjust movable counter-weight for weight class of eggs to be weighed.

(d) Place egg in egg cup; if egg is equal to or heavier than the required weight, the balance will tip.

b. Scale, Dial Indicating, Egg Platform

(1) Used in determining case net weights.

(2) Should be checked for accuracy with test weights.

c. Plate, Egg Testing, Aluminum

(1) Used in determining break-out quality of eggs and in identifying "Loss."

(2) Must be washed after each use; use cold water because hot water will coagualte the egg protein and might stop up plumbing lines.

d. B-B Candling Light

(1) Used in determining interior quality of eggs.

(2) Disassemble before each usage and clean thoroughly.

(3) Convex side of lens must be towards the egg opening.

(4) Convex side of reflector must be towards outside of box.

(5) Adjust reflector (by loosening wing nuts and adjust by hand) to provide maximum intensity of light through the egg opening.

e. Flashlight

f. Hatchet

g. Strap cutters

h. Dial Thermometer - for determining vehicle and internal egg temperatures.

i. Clip Board

j. Case

2. EGG CANDLING ROOM

a. Should be as dark as possible, definitely with no cross beams of light between the inspector and the candling light.

b. Should be air conditioned if possible.

c. Should be large enough to accommodate the candling bench and other inspection equipment, allow adequate movement of the inspector(s), provide room for sample cases and for separation of cases already inspected, and a container for disposing of packing materials and "Loss" eggs.

3. CANDLING TECHNIQUE

a. Candling light should be at a height so that when the inspector, standing erect and holding the egg to the candling light, will have his upper are parallel to his body and his elbow flexed 90°.

b. Examine entire layer of eggs in the case by use of light emitted through the bottom of the candling light - can detect "Dirties," "Leakers," "Shortage," and most "underweight" eggs.

c. Handling the eggs - pick up two eggs in each hand with the small ends together the center of the palm.

d. "Bell" the eggs - tape the two eggs in one hand together lightly to aid in detecting "Checks."

e. Present front egg in one hand to the opening in the candling light, place end to the opening and at a 45° angle, give a quick snap of the wrist through an 180° arc and note air cell and shell contents.

f. As this egg is removed, the front egg in the other hand is presented to the candling lamp in a like manner.

g. As an egg is removed from the candling lamp, swap positions with it and the other egg in the same hand.

4. COUNTING EGGS OF VARIOUS QUALITIES, UNDERWEIGHTS

a. Remember that "underweight" eggs must also be assigned a "quality."

b. Count "Underweights" and record this number.

c. Count "Leakers" and record this number.

d. As you proceed through your 100 eggs, separate the "Loss," "Checks," "Dirties," and "C's;" record these numbers when you have completed your 100 eggs.

e. Keep a mental note of "B's;" record this number when you have completed your 100 eggs.

f. Total "B's," "C's," "Dirties," "Checks," "Leakers," and "Loss" and subtract this total from 100 to get the number of "A's," record this number.

g. Break out "Loss" for positive identification.

5. CANDLING BENCH

(See Diagram at end of this Chapter).

SECTION X - REPORT OF INSPECTION OF SHELL EGGS, DD FORM 1237

1. INSTRUCTIONS - detailed instructions for the preparation of this report are contained in Section 213.2 of the DPSC Handbook.

2. REQUIREMENTS

a. This report does not have to be submitted to DPSC if no discrepancies are found during inspection.

b. Reports submitted to DPSC will have ONLY the FRONT side completed.

c. A separate report is required for each grade and each weight class, in the same shipment (a shipment containing Large A, Medium A, Large B, and Medium B eggs would require four separate reports).

d. A "working copy" of this report will be completed (front and back sides) for every shipment of eggs received. It will be filed in the veterinary office for future reference if needed.

e. Copies of this report will NOT be furnished to unauthorized personnel.

3. CHANGES IN THE FORM

a. Note that "Check" and "Dirty" columns in Block 23 and on the back side are reversed as to "order of acceptability."

b. In Block 23 and on the back side, the "Loss" column should be included under the "US Grade" heading.

c. In Block 23 and on the reverse side, "SHORTAGE" should be marked out and these eggs should be included with "LOSS."

d. A corrected DD Form 1237 is located at the end of this chapter.

4. ABBREVIATIONS FOR IDENTIFYING LOSS

White rot	WR	Stuck yolk	SY	Large meat spots	LMS	Frozen	FZ
Mixed rot	MR	Moldy	MLDY	Large blood spots	LBS	Cooked	CKD
Sour rot	SR	Black rot	BLRT	Shortage	SHTG	Musty	MSTY
Green white	GW	Blood rings	BR	Bloody white	BW		

LMS and LBS are considered as edible loss; other loss categories are considered as inedible loss. In preparing a DD Form 1237, indicate total loss and also the subtotals for edible loss and inedible loss, and shortage.

5. SPECIAL NOTE - as has been mentioned earlier, "Underweight" and "Small End Up" are not "qualities." An egg that was underweight and packed small end up would be listed three times in Block 23 (and on the back side of the work sheet copy).

SECTION L - INSPECTIONS OTHER THAN CLASS 4

1. CLASS 5 (ANY RECEIPT OTHER THAN PURCHASE) INSPECTIONS

a. Not required for domestic shipments.

b. For overseas shipments, inspect a minimum of 10 cases from each lot.

c. It is not desirable to ship eggs having a general quality below Procurement Grade II or with less than 65 percent "A Quality" eggs or more than 1.5 percent combined "Leakers" and "Loss."

3. CLASS 9 (IN STORAGE) INSPECTIONS

a. At least 5 cases from each lot of 400 cases or more will be inspected monthly.

b. Reinspections the following months should be performed on the same eggs so that the results indicate the change that has occurred in grade or condition.

c. Recommendations for immediate use should be based on percentage of Checks, Loss, and/or Leakers present.

d. Lot with more than 2 percent Loss and Leakers or more than 5-7 percent Checks are considered a poor storage risk for more than 30 days.

SECTION M - REPORTING OF NONCOMPLIANCE WITH CONTRACT REQUIREMENTS

1. DESTINATION INSPECTION - is normally for identity, count and condition and for verification of the origin grade and other contract requirements.

a. Identify - this consists of determining that the product is the one called for in the contract and, if inspected at origin, is the product so inspected. This may be accomplished by a survey of the inspection stamps, inspection reports, invoices, manifests labels, or by examination of the product to include opening of containers.

b. Count - this is merely the counting of the number of units received and ascertaining that it is in compliance with the receiving documents.

c. Condition - this consists of determining that the product is in the condition required by the contract; that the packaging and packing are in such condition as to adequately protect the product during its normal storage life.

d. Verification of Origin Grade - this consists of candling of sufficient sample to satisfy the destination inspector as to the validity of the origin inspection.

2. DISTINATION VERIFICATION INSPECTION and use of Tables I and II, "Allowable Variation Limits" from Sec. 213.4 of the DPSC Manual.

a. Purpose of the Table - the table gives a list of the variations allowed from the standard requirements but which will still be considered as acceptable. They allow a slight additional variation in certain factors to compensate for transit degredation due to changes occuring as a result of handling and shipping.

b. Sample size - the "Sample Size" listing in the top of the tables refers to "number of eggs" in the sample (e.g. a sample size listed in the table as 1,600 refers to 16 cases.

c. Use of the Table

(1) Determine sample size from applicable table (see paragraph 6b of DPSC manual subsection 213.4)

(2) Perform inspection procedures and complete DD Form 1237.

(3) Compare inspection results (Block 23 of DD Form 1237) with basic requirements as listed in requirements column of Parts A and B of appropriate table.

(4) If basic requirements are not met, then move to the right and use the figure in the column under the sample size being used.

(5) Special notes on use of table I (Limited Verification):

(a) A first sample is drawn and inspected (see paragraph 4 on page 14 for sample size for lots of less than 100 cases). If the results based on this sample are acceptable, no further inspection is required.

(b) If results of the first sample are not acceptable, additional sample cases are used and then the combined (first plus additional) sample will be considered as the only sample.

d. Action based on use of the Tables.

(1) Results exceed contract requirements but ARE within variation allowances as shown in the appropriate table - shipment is acceptable.

(2) Results exceed contract requirements and ARE NOT within variation allowances as shown in the appropriate table - provisionally reject the shipment and contact DPSC for further instructions.

e. Figures in Tables I and II of subsection 213.4 of the DPSC Manual are not to be released to contractors.

3. CONTACTING DPSC

a. Our contact will be made with the Attending Veterinarian (QAO) at the servicing Regional Headquarters.

b. The following information should be furnished:

(1) Purchase Order Number

(2) Contractor

(3) Product shipped from ____________________

(4) Product shipped to ____________________

(5) Item, quantity and grade called for

(6) All instances of noncompliance in the delivery

c. Your completed working copy of the DD Form 1237 (Report of Inspection of Shell Eggs) should be kept at hand for other information that may be requested.

4. CONTRACTOR OPTIONS IN EVENT OF NONCOMPLIANCE

a. Keep his product

b. Accept the destination inspection and sell the product at a reduced price (if acceptable to the contracting officer).

c. Request a reinspection

5. REINSPECTIONS

a. Veterinary corps

(1) Performed by a qualified disinterested military veterinarian.

(2) This type will be done if the origin inspection was accomplished by the contractor.

b. Formal Review

(1) A reinspection performed by USDA inspectors when the origin inspection was accomplished by the USDA.

(2) Applies only to "Grade," not to damage.

c. Joint - if the origin inspection was accomplished by the contractor, he may at his expense hire the USDA to participate jointly in the reinspection.

SECTION N - EGG PRESERVATION AND STORAGE

1. GENERAL

a. Nearly 60 percent of the total annual egg production occurs in the months of March, April, May and June.

b. Handle storage eggs as little as possible.

c. Begin with the highest possible quality and remember that under absolutely ideal storage conditions, the quality can only change in one direction - downward.

d. The major disadvantage of storage eggs is the possibility of off-flavors and off-odors and the increase in the quantity of thin white, giving poorer cooking qualities for whole eggs.

2. BASIC PRINCIPLES IN STORING EGGS

a. Sealing the pores of the shell to prevent:

(1) Loss of carbon dioxide

(2) Loss of water

(3) Entrance of bacteria

(4) Absorption of off-odors and off-flavors

b. Creating an artificial environment which is not conductive to bacterial growth.

c. Reduction in the number of bacteria present on the shell or in the egg itself.

3. GENERALLY-USED STORAGE METHODS

a. Refrigeration - cold air refrigeration is our most used method; temperature, humidity, and ventilation must be carefully controlled.

(1) Temperature

(a) We desire 29° to 31° F. for extended periods.

(b) Temperatures not in excess of 50° F. may be used for short periods (1-14 days).

(c) Eggs freeze at 28° F. and start to deteriorate at 31° F.

(d) Eggs brought from a cold room to a warm room sill sweat if they are not tempered slowly.

(2) Humidity

(a) We desire a relative humidity of 85-90 percent.

(b) Mold growth proceeds rapidly at relative humidity above 88 percent.

(c) Absorption of moisture is more rapid when the relative humidity is decreased.

(3) Ventilation - essential to aid in control of mold growth and to eliminte foreign odors which might be absorbed by the eggs.

b. Oil Processing

(1) All domestic procurements for overseas shipments are oil treated.

(2) Seals the pores.

(3) Only mineral or paraffin oils are allowed (vegetable oils are not allowed because they become rancid).

(4) Specifications call for complete coverage.

(5) Ways of detecting oil

(a) Note eggs when sweating.

(b) Note presence of oils on packing materials.

(c) Detection by use of oil soluble dyes (Oil, Blue N; catalogue number 599: National Analine Division: Allied Chemical and Dye Corp; 40 Reston Street; New York 6, New York) - will dissolve in the oil and leave a solid color.

c. Heat treatment

(1) "Flash" heating to 153° F. for approximately 15 seconds.

(2) "Thermostabilization"

(a) Eggs are rolled in a hot oil bath at 132° to 134° F. for approximately 15 minutes.

(b) Kills surface bacteria and some subsurface bacteria.

(c) Seals pores by oil coating and by coagulation of the white immediately beneath the shell.

(d) An expensive process and hard to control thermostatically.

(e) It is very difficult to determine the quality of thermo-stabilized eggs other than by break-out.

4. STORAGE LIMITS - the maximum storage period @ 29° to 31° F. and 85-90 percent relative humidity is considered to be four months for export eggs and seven months for eggs for domestic use.

SECTION O - FROZEN AND DRIED EGGS

1. HISTORY

a. Commercial freezing of eggs dates back to 1889; present production is well over 200,000,000 pounds per year.

b. Drying of eggs dates back to 1878 and was first used by the military about 1900 to feed troops in China and Alaska.

2. ADVANTAGES AND USES

a. Lower cost of packing, storing, and transport because of their condensed nature.

b. Less danger of spoilage while in storage.

c. Frozen eggs are used primarily by bakeries and by manufacturers of mayonnaise and dressings; approved by the Air Force for use in cakes, puddings, etc. to be procured.

d. Dried whole eggs or egg constituents can be substituted for fresh whole eggs or egg constituents except where they are not to be cooked or where the final product depends on the foaming quality of the whites.

3. PRODUCTION OF EGG LIQUIDS

a. Strict sanitation is essential.

b. Inspection in the plant must be continuous.

(1) Raw materials - storage temperature and storage time.

(2) Candling - to remove Loss, Leakers, Checks, and Dirties.

(3) Egg washing - water spray at 150° F. then dry with ultraviolet light.

(4) Checks - broken separately and by specially trained personnel.

(5) Sweating eggs.

(6) Cleansing of equipment after contact with any Loss egg.

c. Eggs cooled to maximum of 40° F. before breaking and held below 45° F. throughout the operation.

d. Eggs broken into cups (not more than 2 eggs per cup) or into flat troughs with a slight elevation on one side - allows removal of shell particles, blood spots, Loss eggs not previously removed, etc.

e. Liquid put into large containers and mixed slowly without adding air.

f. Liquid strained to remove shell particles, chalazae, etc.

g. Pasteurized for 3-3 1/2 minutes at 140° to 142° F.

h. Cooled as rapidly as possible to no higher than 45° F. and put into smaller containers.

4. PRODUCTION OF FROZEN EGGS

a. Liquids prepared as in III above.

b. Usually placed in 30 lb. tin cans and frozen at 0° F. or lower; rapid freezing is important because the liquids sour very quickly.

c. Frozen eggs are stored at 0° to -5° F.

d. Forms produced:

(1) Frozen whole eggs

(2) Frozen egg whites

(3) Frozen egg yolks, sugar yolks, and salt yolks - yolks become a gummy mass unless stabilized; stabilizing is usually accomplished by adding sugar, salt, or glycerin.

5. PRODUCTION OF DRIED EGGS

a. Liquids produced as in III above.

b. Liquids piped under a pressure of 1,500-6,000 psi and sprayed into the top of a large funnel-shaped oven with a filtered hot air current at 250° to 400° F.

c. Dried egg powder is collected at the bottom of the drying oven and its moisture content is determined.

d. Secondary drying is accomplished if the moisture content is too high; a maximum of 5 percent moisture is acceptable for commercial products, 2 percent for military procurement.

e. Powder is cooled as rapidly as possible to a maximum of 80° F.

f. Powder is placed in 3 lb. no. 10 cans; air in can is replaced with a mixture of 80 percent carbon dioxide and 20 percent nitrogen (this inert mixture lengthens the storage life of the product but absorption of carbon dioxide may result in paneling of the can).

g. Forms produced:

(1) Dried whole eggs.

(2) Dried yolks.

(3) Dried whites.

h. Equivalents:

(1) Whole eggs are reduced to approximately 1/4 of their original weight.

(2) One lb. of powder is roughly equivalent to 36-40 whole eggs.

(3) Two tablespoons of dry whole eggs plus 2 tablespoons of water is equal to 1 fresh egg.

i. Storage - if stored below 50° F. the 2 percent moisture product has an anticipated storage life of 1 1/2 to 2 years.

6. INSPECTION OF FROZEN AND DRIED EGGS

a. Origin

(1) Primarily concerned with the raw materials, their storage and handling, plant sanitation, and bacteriological and chemical analyses of the finished product.

(2) Sampling of frozen eggs is easily accomplished by using a sterile auger.

(3) Frozen eggs will have a peak at the center of the top of the product if they have been properly handled after freezing (this is caused by the fact that the outer portion of the container freezes first, pushing the remaining liquids to the center).

b. Destination - concerned only with identify, count, and condition, inspect for damage in transit and verification of pakcing and marking requirements.

c. Class 9 (In Storage) - note off-colors and palatability of the product as-is, after reconstituting, and after cooking.

SECTION P - CONSIDERATIONS IN LOCAL PROCUREMENT OF EGGS

1. INFORMATION TO BE INCLUDED IN NOTICES TO PROSPECTIVE SUPPLIERS

a. Refer to Section 5.4, "Eggs," of the DPSC Buyer's Guide.

b. The following information should always be included:

(1) Type - eggs of the domestic chicken hen only.

(2) Condition - fresh or processed fresh, refrigerated storage, or processed refrigerated storage.

(3) Weight class

(4) Quality

(a) USDA Grade or

(b) Brand name - if buying "Brand Name" eggs, see par. 2 below

(6) Other

(a) Point(s) of inspection

(b) Point(s) of acceptance

(c) Date, time, and place of delivery

(d) Any certification required from the vendor

(e) Packing, packaging, and marking requirements

2. CONSIDERATIONS IN PROCUREMENT OF "BRAND NAME" EGGS

a. On purchases of "Brand Name" shell eggs, the only inspection REQUIRED will be that which may be conducted at destination for condition and count and to satisfy any special requirements of the purchase instrument (Par. VI B, Sec. 213.4 of the DPSC Manual).

b. Candling and grading SHOULD be accomplished to develop a "history" of the particular "Brand Name;" "Joe Doe's Best" may be called for a Grade A price but may actually be Grade C eggs.

c. May consider inserting "Fully equal to USDA Grade ______" into the purchase instrument.

d. Conditions warranting provisional of "Brand Name" items (Sec 224.2 of the DPSC Manual):

(1) Not fresh or in prime condition.

(2) Insanitary or unwholesome.

(3) Mislabeled or does not conform to contract requirements.

(4) Item not identical with that specified in the contract.

SECTION Q - CHECK LIST FOR SHELL EGG INSPECTION

1. FROM THE PURCHASE ORDER

a. Inspection point(s).

b. Acceptance point(s).

c. Applicable specifications, deviation lists, special commodity clauses, etc. (note dates very carefully).

d. Delivery dates (and times as applicable).

e. Quantities.

f. Grade.

g. Class.

h. Weight class.

i. Packing level.

j. Other special provisions or requirements which may have been added to the particular purchase order.

2. ON ARRIVAL

a. Grade certificate from contractor or USDA as applicable.

b. Certificate from contractor or USDA (as applicable) as to shipment meeting ALL requirements of the purchase order.

c. Transit temperature (if applicable).

d. Damage in transit.

e. Proper selection of sample cases.

f. Egg internal temperature.

g. Case net weights.

h. Quality determination of individual eggs and completion of the "working copy" of DD Form 1237.

3. FROM THE INSPECTION REPORT (DD FORM 1237) - check results of inspection as shown in Block 23 of completed DD Form 1237 against requirements column of parts A and B of appropriate table in subsection 213.4 of the DPSC Manual.

4. SUMMARY OF PROCUREMENT GRADE REQUIREMENTS - see chart on page 35

SECTION R - REFERENCES, ETC.

1. REFERENCES

a. Regulations Governing the Grading of Shell Eggs and United States Standards, Grades and Weight Classes for Shell Eggs; USDA.

b. Current specifications as listed in the latest Index to Subsistence Specifications.

c. DOD Deviation Lists to Federal Specifications

d. DPSC Special Commodity Clauses.

e. DPSC Operating Manual:

(1) Sec. 213.2 - preparation and Use of DD Form 1237, "Report of Inspection of Shell Eggs."

(2) Sec. 213.4 - Destination Verification Inspection Reports on Shell Eggs

f. List of Plants Operating Under USDA Poultry and Egg Inspection and Grading Programs: USDA (revised every June and December).

g. Regulations Governing the Grading and Inspection of Egg Products; USDA.

h. Egg Grading Manual, Agriculture Handbook No. 75; USDA; revised by 1964.

i. Shell Egg Grader's Handbook; USDA: AMS PY-Instruction No. 910; 2 January 1964.

j. MIL-STD 667 - Minimum Sanitary Standards for Shell Egg Establishments

2. TEXTS

a. Elements of Food and Nutrition, Dowd and Dent.

b. The Avian Egg; Romanoff and Romanoff.

3. CHARTS

a. U.S. Standards for Quality of Individual Eggs; US A; Shows candled and broken out appearances of eggs of various qualities.

b. Know the Eggs you Buy; a large colored chart with pictures of broken out appearances of eggs of various qualities.

4. FILMS AND FILM STRIPS

a. SFS 8-195 (with record), "Shell Egg Grading" - a 52 frame, 15 minute, 35 mm Color film strip describing the various grades of shell eggs. An excellent film strip except for slight discrepancies brought about due to changes in some quality factors for eggs of the various grades and in the order of acceptability.

b. FTA 427, "Fundamentals of Egg Candling" - an 8 minute black and white, 16 mm sound film, showing the procedures of egg candling and inspection. A very good film except for the same discrepancies as listed for SFS 8-195 above.

Table 7-1

SUMMARY OF DESTINATION REQUIREMENTS AND ALLOWANCES (PROCUREM

GRADE REQUIREMENTS

--LOT AVERAGE REQUIREMENTS------------------

	I	II	III	IV		LARGE	MEDIUM
Minimum Average "A's"	80%	60%	40%	20%	Minimum Average Case Net Weight	45.0#	39.5#
Minimum Average "A's and B's"	95%	90%	88.3%	88.3%			
Maximum Average Tolerance Eggs	5%	10%	11.7%	11.7%			
Maximum Checks	4.5%	4.5%	4.5%	4.5%	Maximum Individual Underweight Eggs	3.33%	3.33%
Dirties	.5%	.5%	.5%	.5%			
Leakers	.5%	.5%	.5%	.5%			
Loss (Total)	.3%	.3%	.3%	.3%			
(Other than LMS or LBS)	.2%	.2%	.2%	.2%			

--INDIVIDUAL CASE ALLOWANCES------------------

	I	II	III	IV		LARGE	MEDIUM
"A's" in Any Number of Individual Cases May be as Low as	75%	55%	35%	15%	Minimum Individual Case Net Weights	41.5#	39.0#
In Lots of 200 Cases or More, 1 Case in Each 10 Sampled May be as Low as ______ "A's"	70%	50%	30%	10%			
Tolerance: No Individual Case May Contain More Than ____ Tolerance Eggs	10%	15%	18%	18%			

Table 7-2

WEIGHT CLASSES FOR PROCUREMENT GRADES

WEIGHT CLASS	MINIMUM AVERAGE NET WEIGHT PER 30-DOZEN CASE	MINIMUM NET WEIGHT PER INDIVIDUAL 30-DOZEN CASE	MINIMUM WEIGHT PER DOZEN INDIVIDUAL EGGS	MAXIMUM AVERAGE PERCENT OF INDIVIDUAL UNDERWEIGHT EGGS*
Extra Large	50.5#	50.0#	26 oz	3.33%
Large	45.0#	44.5#	23 oz	3.33%
Medium	39.5#	39.0#	20 oz	3.33%
Small	34.0#	33.5#	17 oz	3.33%

---

*Any number of cases may contain up to 10% individual eggs below minimum weights specified. Underweight eggs must weigh on less than the weight specified for the next lower weight class.

Table 7-3

SUMMARY OF UNITED STATES STANDARDS FOR QUALITY OF INDIVIDUAL SHELL EGGS

Specifications for Each Quality Factor

Quality Factor	AA Quality	A Quality	B Quality	C Quality
Shell	Clean. Unbroken. Practically normal.	Clean. Unbroken. Practically normal.	Clean; to slightly stained. Unbroken. May be slightly abnormal.	Clean; to moderately stained. Unbroken. May be abnormal.
Air Cell	1/8 inch or less in depth. Practically regular.	3/16 inch or less in depth. Practically regular.	3/8 inch or less in depth. May be free or bubbly.	May be over 3/8 inch in depth. May be free or bubbly.
White	Clear. Firm.	Clear. May be reasonably firm.	Clear. May be slightly weak.	May be weak and watery. Small blood clots or spots may be present.*
Yolk	Outline slightly defined. Practically free from defects.	Outline may be fairly well defined. Practically free from defects.	Outline may be well defined. May be slightly enlarged and flattened. May show definite but not serious defects.	Outline may be plainly visible. May be enlarged and flattened. May show clearly visible germ development but no blood. May show other serious defects.

* If they are small (aggregating not more than 1/8 inch in diameter)

For eggs with dirty or broken shells, the standards of quality provide three additional qualities. These are:

Dirty	Check	Leaker
Unbroken. May be dirty	Checked or cracked but not leaking.	Broken so contents are leaking.

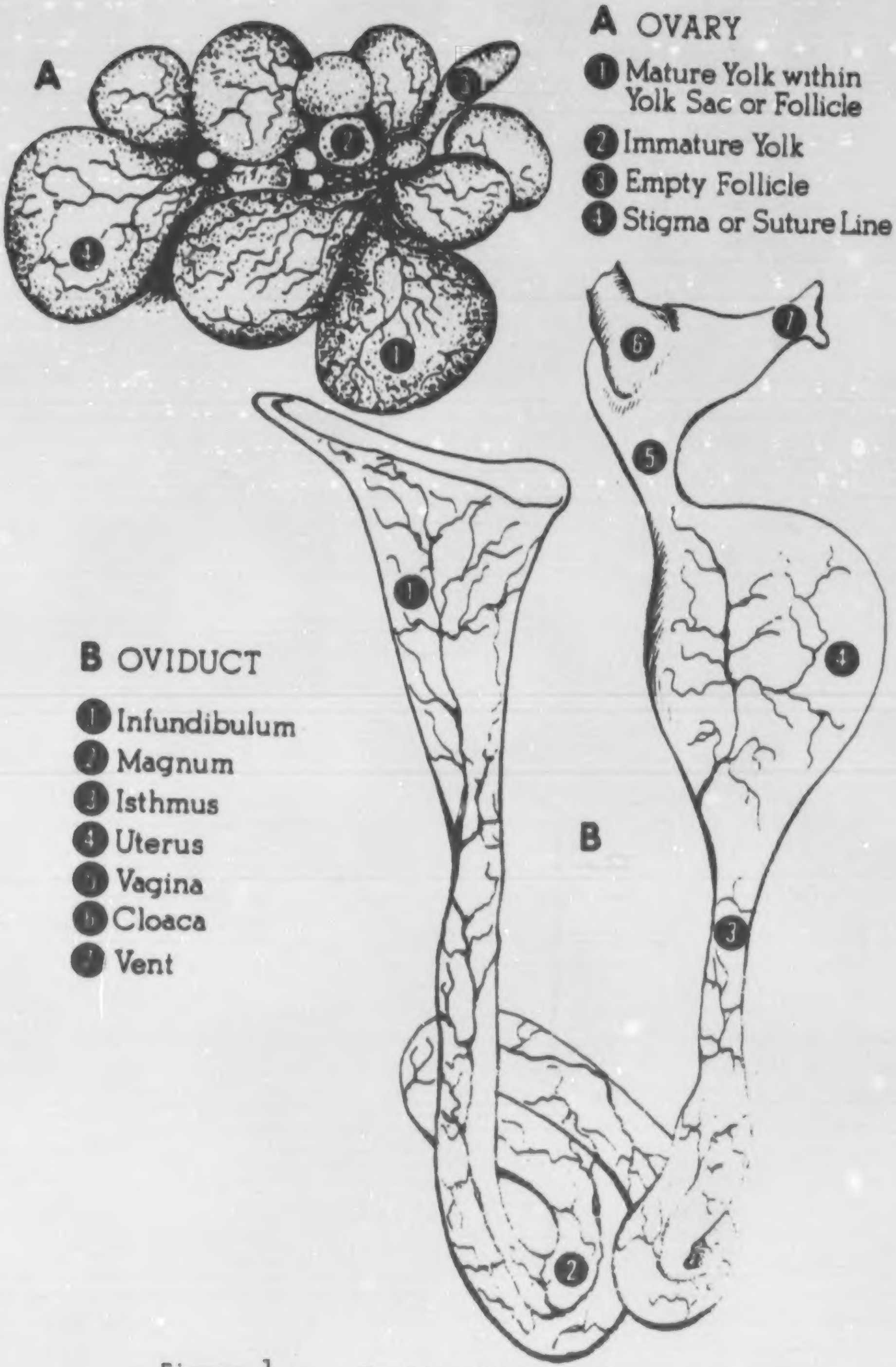
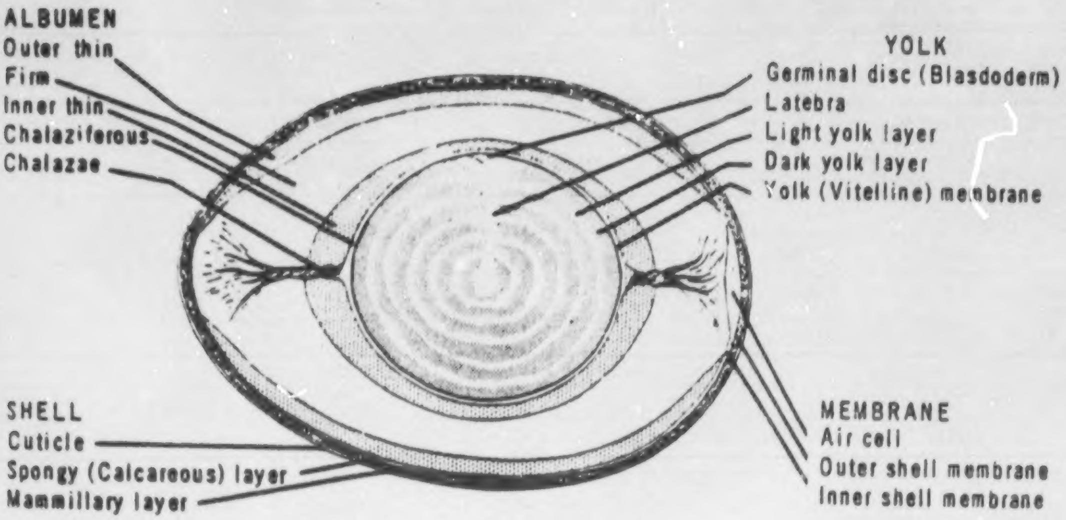
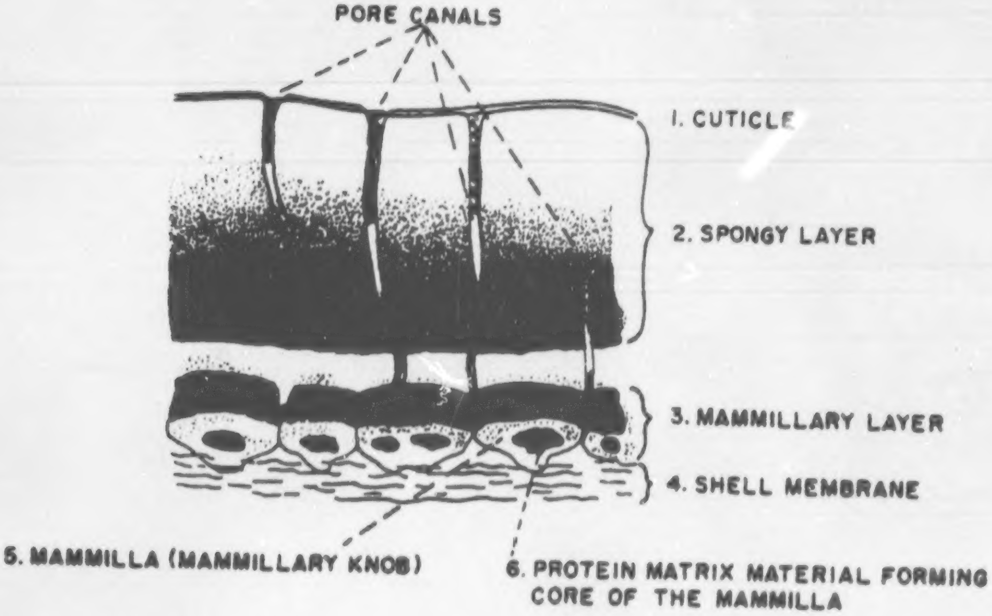


Figure 1 Poultry Reproductive Tract.



THE PARTS OF AN EGG


PORE CANALS
1. CUTICLE
2. SPONGY LAYER
3. MAMMILLARY LAYER
4. SHELL MEMBRANE
5. MAMMILLA (MAMMILLARY KNOB)
6. PROTEIN MATRIX MATERIAL FORMING CORE OF THE MAMMILLA

MAGNIFIED RADIAL SECTION THROUGH THE SHELL

Figure 2

CANDLING BENCH

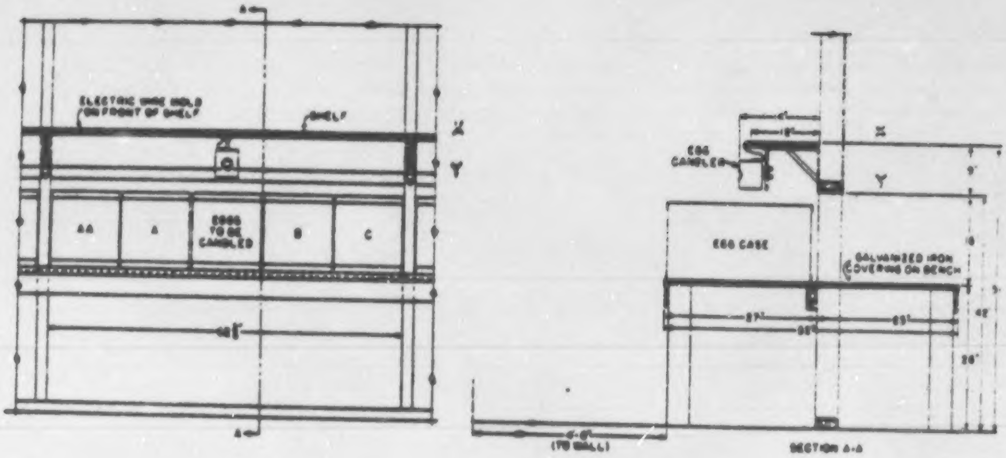
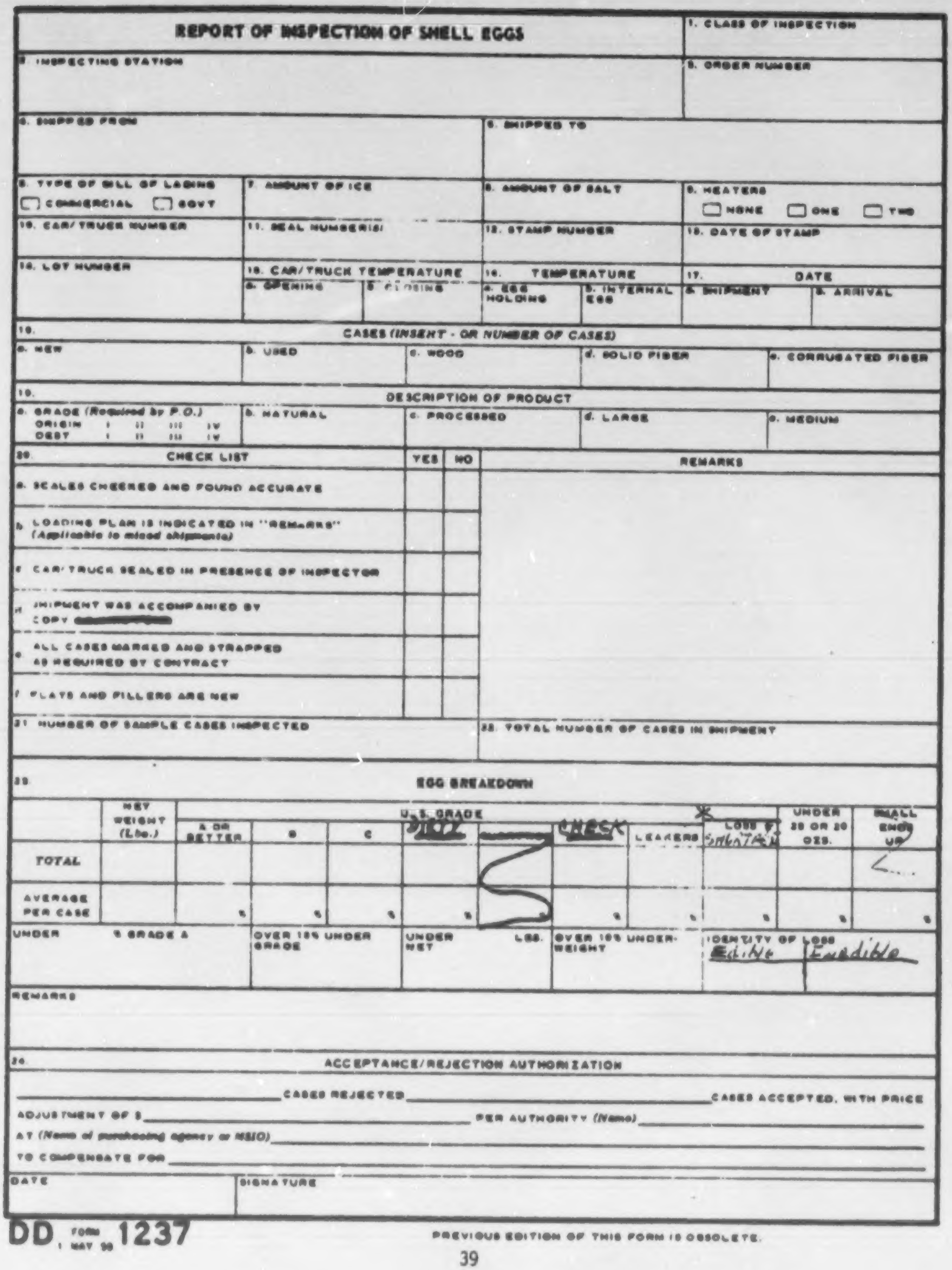


Figure 3

Figure 4



REPORT OF INSPECTION OF SHELL EGGS

1. CLASS OF INSPECTION

2. INSPECTING STATION

3. ORDER NUMBER

4. SHIPPED FROM

5. SHIPPED TO

6. TYPE OF BILL OF LADING ☐ COMMERCIAL ☐ GOVT

7. AMOUNT OF ICE

8. AMOUNT OF SALT

9. HEATERS ☐ NONE ☐ ONE ☐ TWO

10. CAR/TRUCK NUMBER

11. SEAL NUMBER(S)

12. STAMP NUMBER

13. DATE OF STAMP

14. LOT NUMBER

15. CAR/TRUCK TEMPERATURE a. OPENING b. CLOSING

16. TEMPERATURE a. EGG HOLDING b. INTERNAL EGG

17. DATE a. SHIPMENT b. ARRIVAL

18. CASES (INSERT - OR NUMBER OF CASES)

a. NEW b. USED c. WOOD d. SOLID FIBER e. CORRUGATED FIBER

19. DESCRIPTION OF PRODUCT

a. GRADE (Required by P.O.)
ORIGIN I II III IV
DEST I II III IV

b. NATURAL c. PROCESSED d. LARGE e. MEDIUM

20. CHECK LIST	YES	NO	REMARKS
a. SCALES CHECKED AND FOUND ACCURATE			
b. LOADING PLAN IS INDICATED IN "REMARKS" (Applicable to mixed shipments)			
c. CAR/TRUCK SEALED IN PRESENCE OF INSPECTOR			
d. SHIPMENT WAS ACCOMPANIED BY COPY [redacted]			
e. ALL CASES MARKED AND STRAPPED AS REQUIRED BY CONTRACT			
f. FLATS AND FILLERS ARE NEW			

21. NUMBER OF SAMPLE CASES INSPECTED

22. TOTAL NUMBER OF CASES IN SHIPMENT

23. EGG BREAKDOWN

	NET WEIGHT (Lbs.)	U.S. GRADE									
		A OR BETTER	B	C	DIRTY		CHECK	LEAKERS	LOSS OF SHRINKAGE	UNDER 28 OR 20 OZS.	SMALL END UP
TOTAL											
AVERAGE PER CASE		%	%	%	%	%	%	%	%	%	%

UNDER % GRADE A

OVER 15% UNDER GRADE

UNDER NET LBS.

OVER 10% UNDER-WEIGHT

IDENTITY OF LOSS Edible Inedible

REMARKS

24. ACCEPTANCE/REJECTION AUTHORIZATION

________ CASES REJECTED ________ CASES ACCEPTED, WITH PRICE
ADJUSTMENT OF $ ________ PER AUTHORITY (Name) ________
AT (Name of purchasing agency or MSIO) ________
TO COMPENSATE FOR ________

DATE

SIGNATURE

DD FORM 1 MAY 59 1237

PREVIOUS EDITION OF THIS FORM IS OBSOLETE.

Figure 5 (Reverse)

INSPECTION OF INDIVIDUAL CASES OF EGGS (TO BE ACCOMPLISHED AT TIME OF INSPECTION AND HELD ON FILE ONE YEAR)

SAMPLE NUMBER	NET WEIGHT (Lbs.)	U. S. GRADE									
		A OR BETTER	B	C	DIRTY		CHECK	LEAKERS	LOSS SHORTAGE	UNDER 23 OR 20 OZS.	~~SMALL~~ ENDS UP
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											
21											
22											
23											
24											
25											
26											
27											
28											
29											
30											
TOTAL											
AVERAGE PER CASE		%	%	%	%		%	%	%	%	%
REMARKS											

PROGRAMMED TEXT 3ABR90830-VII-3
PROGRAMMED TEXT 30BR9921-1-II-10

DEPARTMENT OF VETERINARY MEDICINE

VETERINARY SPECIALIST

VETERINARIAN

1-4

EGG INSPECTION

November 1974

SCHOOL OF HEALTH CARE SCIENCES, USAF
SHEPPARD AIR FORCE BASE, TEXAS

Designed For ATC Course Use

DO NOT USE ON THE JOB

151

PURPOSE OF STUDY GUIDES, WORKBOOKS, PROGRAMMED TEXTS AND HANDOUTS

Study Guides, Workbooks, Programmed Texts and Handouts are training publications authorized by Air Training Command (ATC) for student use in ATC courses.

The STUDY GUIDE (SG) presents the information you need to complete the unit of instruction, or makes assignments for you to read in other publications which contain the required information.

The WORKBOOK (WB) contains work procedures designed to help you achieve the learning objectives of the unit of instruction. Knowledge acquired from using the study guide will help you perform the missions or exercises, solve the problems, or answer questions presented in the workbook.

The STUDY GUIDE AND WORKBOOK (SW) contains both SG and WB material under one cover. The two training publications are combined when the WB is not designed for you to write in, or when both SG and WB are issued for you to keep.

The PROGRAMMED TEXT (PT) presents information in planned steps with provisions for you to actively respond to each step. You are given immediate knowledge of the correctness of each response. PTs may either replace or augment SGs and WBs.

The HANDOUT (HO) contains supplementary training materials in the form of flow charts, block diagrams, printouts, case problems, tables, forms, charts, and similar materials.

Training publications are designed for ATC course use only. They are updated as necessary for training purposes, but are NOT to be used on the job as authoritative references in preference to Technical Orders or other official publications.

Department of Veterinary Medicine
School of Health Care Sciences, USAF
Sheppard Air Force Base, Texas

PT 3ABR90830-VII-3
PT 3OBR9921-1-II-10
November 1974

EGG INSPECTION

OBJECTIVE

With the aid of this Programmed Text, the student will be able to identify the grading factors of individual eggs and the procedures involved in reading contracts, specifications, and the Tables of Allowable Variations. This will enable the student to determine contract compliance and recommend proper disposition of shell eggs.

INTRODUCTION

This Programmed Text outlines the concepts involving the formation and composition of the egg and the quality factors of shell eggs. Information concerning DD Form 1237 is also included so that the student will have a working knowledge of the Egg Inspection Report used for shell eggs.

This supersedes PT 3ABR90830-X-2/3OBR9921-1-III-3, Egg Inspection, September 1973.

This Programmed Text has been designed as a self-teaching device for use by students of the Veterinary Officer Basic and Veterinary Specialist Courses. It enables each student to progress at his own rate and frees the instructor to give additional assistance as may be needed.

Study questions are found throughout the Text to help assure you that you have gotten what you should from it. If you are unable to answer any of these questions, return to your reading assignment and search for the answers.

It is imperative that you follow the directions exactly as they are given. Since the Program is self-teaching, naturally it is possible for you to skip over it lightly. Remember -- if you cheat, you are only cheating yourself! Now is the time to learn the material, not when you're on the job and faced with the responsibility for rendering an immediate decision.

To complete this block of instruction, you will need the following materials in addition to this Program:

Student Text, Egg Inspection (Chapter 7) (ST 3ABR90830-VII-2)

DPSC Manual, Subsection 213.2, Preparation and Use of DD Form 1237, "Report of Inspection of Shell Eggs"

1 Copy (blank) of DD Form 1237

DPSC Manual, Subsection 213.4, Destination Verification Inspection Reports on Shell Eggs

The inspection of eggs is an important aspect of the duties of Veterinary Service personnel. Eggs play an important role in providing a balanced diet for Air Force personnel. Large numbers of eggs are used for feeding in our food service facilities and for resale through commissary sales stores.

Read all of section A in the Student Textbook and then answer the questions below.

Q1. From the standpoint of nutritive value, eggs are

a. an excellent source of all known vitamins.
b. deficient in vitamins A and D.
c. an excellent source of vitamin C.
d. an excellent source of vitamins A and D but a poor source of vitamin C.

Q2. In regards to egg inspection, Veterinary Service personnel are concerned with

a. destination inspection only.
b. surveillance inspection only.
c. destination and surveillance inspection.
d. destination and surveillance inspection plus giving advice relative to local procurement of eggs.

Proceed to page 4 to verify your answers and to get your next instructions.

A1. The correct answer is "d. An excellent source of vitamins A and D but a poor source of vitamin C."

Since vitamins A and D are fat soluble vitamins, they are found primarily in the yolk which is approximately 30% fat. Eggs are deficient in vitamin C, however.

A2. The correct answer is "d. Destination and surveillance inspection plus giving advice relative to local procurement of eggs."

If you answered both of the above questions correctly, you are ready to proceed with the rest of the material.

Our first knowledge of a pending shipment of eggs is usually the receipt of a copy of the purchase order (Order for Subsistence). On page 4, you will find a copy of such a document. Look it over very closely, noting all of the information which it furnishes in regards to the particular shipment.

Now turn to page 7-28 in the Student Text and read paragraph 1.

On the purchase order, find each of the bits of information referred to (except for item J when it is not applicable).

Continue on to page 7.

156

MIP NO. DSA 135-70-M-0324 | ADDENDUM NO. 9 | DET NO. 70-97 | SA CODE NSA | LS CODE

ORDER FOR SUBSISTENCE

1. THIS PURCHASE IS NEGOTIATED UNDER AUTHORITY OF 10 USC 2304(a) (9)

2. ISSUED BY
SUBSISTENCE RH NEW ORLEANS, DPSC
4400 DAUPHINE STREET
NEW ORLEANS, LOUISIANA 70140

3. VENDOR
118900-44-1220-2
CONTINENTAL PRODUCE COMPANY
P. O. BOX 16
GONZALES, TEXAS 78629

4. ☐ DELIVERY ORDER — THIS DELIVERY ORDER IS SUBJECT TO TERMS AND CONDITIONS OF FOLLOWING BASIC CONTRACT:

5. ☒ PURCHASE ORDER — IN ACCORDANCE WITH YOUR OFFER OF 70 Sep 16 REQUEST YOU FURNISH THE FOLLOWING ON THE TERMS SPECIFIED IN THIS ORDER.

6. TO: MANIFEST MUST ACCOMPANY SHIPMENT
T/O FOR COMMISSARY OFFICER
SHEPPARD AFB, TEXAS

7. DELIVERY DATE(S) 70 SEP 29 (272)
SHIPMENTS WILL NOT BE ACCEPTED AFTER 12 NOON ON DELIVERY DATES SPECIFIED, NOR AT ANY TIME ON SATURDAY, SUNDAY OR A NATIONAL HOLIDAY

8. INSPECTION POINT
VENDOR ORIGIN-CONTRACTOR PAID USDA INSPECTION

9. ACCEPTANCE POINT ☒ DESTN ☐ ORIGIN

10. DELIVERY F.O.B. ☒ DESTN ☐ (As specified in schedule)

11. DELIVERY ORDER NUMBER

12. PAGE 1 of 3 PAGES

13. CONTRACT NUMBER
DSA 135-71-M-U306

14. DATE OF ORDER
70 Sep 16

15. PURCHASE REQUEST NUMBER
SHOWN HEREIN

16. DISCOUNT TERMS
NONE

17. INVOICES WILL BE MAILED TO AND PAYMENT WILL BE MADE BY
FINANCE AND ACCOUNTING OFFICER
SUBSISTENCE RH NEW ORLEANS, DPSC
4400 DAUPHINE STREET
NEW ORLEANS, LOUISIANA 70140

1970 SEP 25

18. ACCOUNTING AND APPROPRIATION DATA
97X4961.5103 7526 S 16-057
REIMBURSEMENT FUND CODE: SHOWN HEREIN DA 14-115 5-71

19. TO BE FILLED IN BY THE CONTRACTOR WHEN SHIPMENT OF NON-PERISHABLES IS MADE TO DEPOTS, SUPPLY CENTERS AND TERMINALS.

20. DATE SHIPPED
21. TOTAL NO. PCS
22. TOTAL CUBE
23. TOTAL GROSS WT.
24. CAR NO.
25. SEAL NO.
26. GBL NO.
27. AWARD LINE ITEM NOS.
28. ETR NO.
29. ROUTING
30. SHIPPING POINT
31. SHIPMENT NO.
32. FINAL SHIPMENT ☐

VETERINARY INSPECTOR

33. SCHEDULE

AWARD LINE ITEM NO.	STOCK NO. AND DESCRIPTION OF SUPPLIES	S. P.	T. P.	QUANTITY (Units)	UNIT	UNIT PRICE	TOTAL PRICE
	DO-C9 CERTIFIED FOR NATIONAL DEFENSE USE UNDER DMS REG. NO. 1. EGGS, SHELL. Fed Spec C-E-271f, 16 Jul 64 and Int Amend-2, Oct 20, 1969. DPSC Articles 137, DPSC Articles 271 and DPSC Articles 75a-d and DPSC General Articles 78 of dates as cited elsewhere in solicitation or contract, except MIL-T-43372A referenced in Articles 78 is revised by deleting the origin temperature requirement for shell eggs, Procurement Grade I. Large. Marking in accordance with cited product specification and MIL-STD-129 and DPSC Articles as cited in the solicitation.						

34. THE FOLLOWING PROVISIONS ARE INCORPORATED HEREIN BY REFERENCE:
DPSC Clauses 18 a-c 70 Jan 02
DPSC Clauses 20 a&b 70 Jan 02
DPSC Clauses 104 69 Sep 02
DDPSC Form 3020 1,2 5-8 70 Jun; 364 69 Dec

35. TOTAL 2,741.25

UNITED STATES OF AMERICA
BY Contracting Officer
W. W. PIRKLE

36. SUMMARY FILED IN: U307 StahmannFarms

DPSC FORM 300 OCT 66

25	26	27	28	29	30	31	37-39	40	41	42	44-45	74	75	76	77	77	78-79	57-64
1	2	4	-	5	2	2	1	1	1	1	04	-	-	-	2	2	-	2740
PA	JD	SBA	LA	NA	PA	FP	TLI	PA	IPT	IP	C	DP	TL	TB	DVG	FP	SP	TOTAL POUNDS

EDITION SEP 67, OBSOLETE.
5

70 SEP 17

R-80

157

ORDER FOR SUBSISTENCE *CONTINUATION SHEET*	ORDER NO.	PAGE NO.	NO. OF PAGES
		3	3
	CONTRACT NUMBER DSA 135-71-M-U306		

SCHEDULE

ITEM NUMBER	STOCK NO. AND DESCRIPTION OF SUPPLIES	S.P.	T.P.	QUANTITY (Units)	UNIT	UNIT PRICE	TOTAL PRICE
	(8910-222-0539-0) Condition 1, Fresh and/or Condition 2, Processed Fresh. Level C Packing. MEDIUMS MAY BE SUBSTITUTED FOR LARGE AT .3732 per doz REQN: FT3020-0204-C064 Y00000 A 62 03600 - 7740			2,400	dz	.4250	1,020.00

Did you find two separate places on the "Order for Subsistence" where other documents pertaining to this particular shipment are listed? If you did not, then look again. If you still can't find them, ask your instructor for help.

Some of this information may be vague to you and need further explanation. Turn to page 7-18 in your Student Text and read paragraph 8 pertaining to "Classes" (Conditions) of eggs.

Most of the eggs procured by the Department of Defense are Condition I, Fresh. Occasionally, Condition II, Shell, Protected, Fresh eggs are procured in the U.S. for shipment to overseas areas.

Q3. To be considered "fresh", eggs must have been held in storage not more than

a. 7 days.
b. 14 days.
c. 29 days.
d. 30 days.

A3. The correct answer is "d. 30 days." Some of you may question this, but it is in accordance with the July, 1964 revision of Federal Specification C-E-271.

Now turn to page 7-14 in your Student Text and read paragraphs 1 and 2 having to do with grading and grading systems.

Q4. Most eggs procured by the DOD are

a. Consumer Graded.
b. Wholesale Graded.
c. Procurement Graded.
d. Export Graded.

A4. The correct answer is "c. Procurement Graded."

The DOD buys some "Consumer Graded" eggs for resale or for hospital use, but most are graded under the "Procurement Grade" system.

We are also concerned with weight classes. Turn to page 7-15 in the Student Text and read paragraphs 1, 2, and 3.

Now work the problems on the next page (page 10). If you have any difficulty with them, ask your instructor for help. Check your answers against the answers given on page 11. If you missed any of them, check against the table on page 7-31 in your Student Text.

Q5. You have received a number of cases of eggs with individual case weights as listed below. Classify each case as to its proper weight class.

Case Weight	Weight Class	Case Weight	Weight Class
a. 44.0 lbs		f. 44.5 lbs	
b. 40 5 lbs		g. 39.0 lbs	
c. 42.5 lbs		h. 38.5 lbs	
d. 48.0 lbs		i. 41.5 lbs	
e. 49.5 lbs		j. 40.5 lbs	

Q6. You have several "lots" of eggs with average case net weights as shown below. Classify each lot as to its proper weight class.

Weight	Weight Class	Weight	Weight Class
a. 44.0 lbs		f. 44.5 lbs	
b. 40.5 lbs		g. 39.0 lbs	
c. 42.5 lbs		h. 38.5 lbs	
d. 48.0 lbs		i. 41.5 lbs	
e. 49.5 lbs		j. 40.5 lbs	

A5. a. Medium
    b. Medium
    c. Medium
    d. Large
    e. Large
    f. Large
    g. Medium
    h. Small
    i. Medium
    j. Medium

A6. a. Medium
    b. Medium
    c. Medium
    d. Large
    e. Large
    f. Medium
    g. Small
    h. Small
    i. Medium
    j. Medium

Your next concern is with packing levels. Turn to page 7-17 in your Student Text and read paragraph 6.

Q7. Most eggs procured in the U.S. for consumption in the U.S. are of

a. A level pack.
b. B level pack.
c. C level pack.

A7. The correct answer is "c. C level pack."

Now take a look at the form which is used for reporting your inspections of shell eggs (see page 13). It is a DD Form 1237, Report of Inspection of Shell Eggs.

You should also have a blank copy of this form which your instructor gave you. Results of work to be done later in class should be entered on this loose form as it will be easier to handle than a page in the Program would be.

Read section k, page 7-20 in your Student Text.

Fill in blanks 1 through 6 on your blank DD Form 1237. You can get the information from your purchase order (page 5). Additional instructions on completion of the form, if needed, are in subsection 213.2 of the DPSC Manual. After you have entered this information (blanks 1 through 6), check your form against the answer sheet on page 15 to be sure that you have done it correctly.

You have now completed your DD Form 1237 as far as you can until the eggs arrive. What else can and should you do before then?

One item of extreme importance is to check all documents referred to in the purchase order to be sure that you have them and that they are of the correct date.

Then you should be sure that all of your equipment is in proper working order. Turn to page 7-18 in your Student Text and read paragraph 1.

2B-75-743

An egg inspection kit is on display in the classroom. Examine its components very carefully and be sure that you understand their use. Ask your instructor for assistance if you have any questions.

164

REPORT OF INSPECTION OF SHELL EGGS

1. CLASS OF INSPECTION

2. INSPECTING STATION

3. ORDER NUMBER

4. SHIPPED FROM

5. SHIPPED TO

6. TYPE OF BILL OF LADING ☐ COMMERCIAL ☐ GOVT

7. AMOUNT OF ICE

8. AMOUNT OF SALT

9. HEATERS ☐ NONE ☐ ONE ☐ TWO

10. CAR/TRUCK NUMBER

11. SEAL NUMBER(S)

12. STAMP NUMBER

13. DATE OF STAMP

14. LOT NUMBER

15. CAR/TRUCK TEMPERATURE a. OPENING b. CLOSING

16. TEMPERATURE a. EGG HOLDING b. INTERNAL EGG

17. DATE a. SHIPMENT b. ARRIVAL

18. CASES (INSERT - OR NUMBER OF CASES)

a. NEW b. USED c. WOOD d. SOLID FIBER e. CORRUGATED FIBER

19. DESCRIPTION OF PRODUCT

a. GRADE (Required by P.O.) ORIGIN I II III IV DEST. I II III IV

b. NATURAL c. PROCESSED d. LARGE e. MEDIUM

20. CHECK LIST	YES	NO	REMARKS
a. SCALES CHECKED AND FOUND ACCURATE			
b. LOADING PLAN IS INDICATED IN "REMARKS" (Applicable to mixed shipments)			
c. CAR/TRUCK SEALED IN PRESENCE OF INSPECTOR			
d. SHIPMENT WAS ACCOMPANIED BY COPY OF THIS FORM			
e. ALL CASES MARKED AND STRAPPED AS REQUIRED BY CONTRACT			
f. FLATS AND FILLERS ARE NEW			

21. NUMBER OF SAMPLE CASES INSPECTED

22. TOTAL NUMBER OF CASES IN SHIPMENT

23. EGG BREAKDOWN

	NET WEIGHT (Lbs.)	U. S. GRADE								UNDER 23 OR 20 OZS.	Int ~~[illegible]~~ 4/7
		A OR BETTER	B	C	CHECK	~~[illegible]~~	DIRTY	LEAKERS	~~LOSS~~ [illegible]		
TOTAL											
AVERAGE PER CASE		%	%	%	%	%	%	%	%	%	%

UNDER 70 % GRADE A

OVER 4 % UNDER GRADE

UNDER NET LBS.

OVER 10% UNDERWEIGHT

IDENTITY OF LOSS

REMARKS

24. ACCEPTANCE/REJECTION AUTHORIZATION

______ CASES REJECTED ______ CASES ACCEPTED. (AT) PRICE

ADJUSTMENT OF $______ PER AUTHORITY (Name)______

AT (Name of purchasing agency or MSIO)______

TO COMPENSATE FOR ______

DATE

SIGNATURE

DD FORM 1 MAY 57 1237

PREVIOUS EDITION OF THIS FORM IS OBSOLETE.

INSPECTION OF INDIVIDUAL CASES OF EGGS (TO BE ACCOMPLISHED AT TIME OF INSPECTION AND HELD ON FILE ONE YEAR)

SAMPLE NUMBER	NET WEIGHT (Lbs.)	U. S. GRADE A OR BETTER	B	C	CHECK	~~[illegible]~~	DIRTY	LEAKERS	LOSS or SHORTAGE	UNDER 23 OR 20 OZS.	[illegible]
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											
21											
22											
23											
24											
25											
26											
27											
28											
29											
30											
TOTAL											
AVERAGE PER CASE		%	%	%	%		%	%	%	%	%

REMARKS:

FOR SCHOOL USE ONLY - FIGURES CHANGED

REPORT OF INSPECTION OF SHELL EGGS	1. CLASS OF INSPECTION 4 - Verification
2. INSPECTING STATION Veterinary Service Sheppard AFB, Texas	3. ORDER NUMBER DSA 135-71-M-U 306
4. SHIPPED FROM Continental Produce Co. Gonzales, Texas	5. SHIPPED TO Commissary Officer Sheppard AFB, Texas

6. TYPE OF BILL OF LADING ☒ COMMERCIAL ☐ GOVT	7. AMOUNT OF ICE Mech Ref	8. AMOUNT OF SALT None	9. HEATERS ☒ NONE ☐ ONE ☐ TWO
10. CAR/TRUCK NUMBER Vendor's	11. SEAL NUMBER(S) Padlock	12. STAMP NUMBER 485096914	13. DATE OF STAMP 0-273

14. LOT NUMBER	15. CAR/TRUCK TEMPERATURE		16. TEMPERATURE		17. DATE	
	a. OPENING	b. CLOSING	a. EGG HOLDING	b. INTERNAL EGG	a. SHIPMENT	b. ARRIVAL
N/A	40°F	N/A	35°F	40°F	29 Sept 70	30 Sept 70

18. CASES (INSERT - OR NUMBER OF CASES)

a. NEW	b. USED	c. WOOD	d. SOLID FIBER	e. CORRUGATED FIBER
80	None	None	None	80

19. DESCRIPTION OF PRODUCT

a. GRADE (Required by P.O.)	b. NATURAL	c. PROCESSED	d. LARGE	e. MEDIUM
ORIGIN [✓ I] II III IV DEST. [✓ I] II III IV	None	80	80	None

20. CHECK LIST	YES	NO	REMARKS
a. SCALES CHECKED AND FOUND ACCURATE	X		
b. LOADING PLAN IS INDICATED IN "REMARKS" (Applicable to mixed shipments)	N/A		
c. CAR/TRUCK SEALED IN PRESENCE OF INSPECTOR		X	
d. SHIPMENT WAS ACCOMPANIED BY COPY OF [illegible] USDA Grad. Cert. SR 95099	X		
e. ALL CASES MARKED AND STRAPPED AS REQUIRED BY CONTRACT	X		
f. PLATE AND FILLERS ARE NEW	X		

21. NUMBER OF SAMPLE CASES INSPECTED	22. TOTAL NUMBER OF CASES IN SHIPMENT
5	80

23. EGG BREAKDOWN

	NET WEIGHT (Lbs.)	U. S. GRADE								UNDER 20 OZS.	Int Egg Temp
		A OR BETTER	B	C	CHECK		DIRTY	LEAKERS	~~LOSS~~ SAS.		
TOTAL	239.0	382	77	36	4		1			11	[redacted]
AVERAGE PER CASE	47.80	76.40 %	15.40 %	7.20 %	0.80 %	%	0.20 %	%	%	2.20 %	[redacted] %

UNDER 90 % GRADE A	OVER 70 UNDER GRADE	UNDER NET 44.5 LBS.	OVER 10% UNDERWEIGHT	IDENTITY OF LOSS
None	16	None	None	None

REMARKS

24. ACCEPTANCE/REJECTION AUTHORIZATION

No CASES REJECTED 80 CASES ACCEPTED, WITH PRICE

ADJUSTMENT OF $ N/A PER AUTHORITY (Name) N/A

AT (Name of purchasing agency or NSIO) N/A

TO COMPENSATE FOR N/A

DATE	SIGNATURE
30 Sept 70	Neil F. Chapman, Major, USAF, VC

DD FORM 1 MAY 58 1237

PREVIOUS EDITION OF THIS FORM IS OBSOLETE.

FOR SCHOOL USE ONLY - FIGURES CHANGED

167

FOR SCHOOL USE ONLY - FIGURES CHANGED

INSPECTION OF INDIVIDUAL CASES OF EGGS (TO BE ACCOMPLISHED AT TIME OF INSPECTION AND HELD ON FILE ONE YEAR)

SAMPLE NUMBER	NET WEIGHT (Lbs.)	U. S. GRADE							*	UNDER 23 OR 20 OZS.	[redacted]
		A OR BETTER	B	C	CHECK		DIRTY	LEAKERS	LOSS ~~SHORTAGE~~		
1	46.5	75	16	8	1					1	[redacted]
2	48.5	73	11	15				1			
3	47.5	78	16	6							[redacted]
4	46.5	82	10	5	3					10	
5	50.0	74	24	2							[redacted]
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											
21											
22											
23											
24											
25											
26											
27											
28											
29											
30											
TOTAL	239.0	382	77	36			4	1		11	[redacted]
AVERAGE PER CASE	47.80	76.40 %	15.40 %	7.20 %	%	%	0.80 %	0.20 %	%	2.20 %	[redacted]

NOTE: INFORMATION ON THIS SIDE (WORKSHEET SIDE) OF THE DD FORM 1237 IS TO BE PUT ONLY ON YOUR OFFICE FILE COPY.

REMARKS

FOR SCHOOL USE ONLY - FIGURES CHANGED

Now we can relax until the eggs arrive.

When the eggs are delivered, our first concern is the origin inspector's report. A copy of an origin inspector's report is found on page 18. Examine it very closely and note the information which it supplies.

Turn to page 7-16 in your Student Text and read paragraph 1.

Now turn to page 7-13 in your Student Text and read paragraph 1.

Q8. If a shipment of eggs consisted of 205 30-dozen cases, the origin grading

a. must have been done by the USDA.
b. could have been done by either the vendor or the USDA at the vendor's option.

Turn to page 19.

FOR SCHOOL USE ONLY - FIGURES CHANGED

FORM PY-212B
(1-1-66)
COPY

U.S. DEPARTMENT OF AGRICULTURE
CONSUMER AND MARKETING SERVICE
POULTRY DIVISION

EGG GRADING CERTIFICATE

ISSUED IN COOPERATION WITH: Texas Dept of Agri

PLACE ISSUED: Dallas, Texas

DATE: Sept 29, 1970

DSA 135-71-M-U 306

R 75099

TO: APPLICANT (NAME AND ADDRESS)
Continental Produce Co.
Gonzales, Texas

NAME AND ADDRESS OF CONSIGNOR[1]
Continental Produce Co.
Gonzales, Texas

NAME AND ADDRESS OF CONSIGNEE[1]
Commissary Officer
Sheppard AFB, Texas

WHERE EXAMINED: P.O. Box 16
Gonzales, Texas

DESCRIPTION OF:

EGGS[1]: Shell, Protected, White

CASE: 30-Dozen, Taped New Fiberboard

FILLERS AND FLATS: New, Gray

WHERE HELD AND TEMPERATURE: Plant Cooler 38° F.

WAREHOUSE NO., CAR NO.: N/A

TOTAL CASES: 80

CASES EXAMINED: 5

☐ SAMPLE
☒ ALL

CASES WERE STAMPED WITH: USDA Military Provisional

OFFICIAL GRADE AND SIZE: U.S. Procurement #1 Large

CASE NO.	NET WEIGHT[2]	AA	A	B	C	DIRTIES	CHECKS	LOSS	CHARACTER OF LOSS	SHORTAGE[3]	UNDER 23 OZ.[4]	CASE TEMP.	SMALL END UP[4]
1	48.00		90	7	1		2					53	
2	47.50		90	9			1				1	56	
3	48.25		88	8	1		3					48	
4	47.75		90	9			1					46	1
5	47.50		87	10			3					49	
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16													
17													
18													
19													
20													
TOTAL	239		445	43	2		10				1		1
AVERAGE	47.8		89.0	8.6	0.4		2.0				0.2		0.2

[1] As stated by applicant or contractor. [2] Weights based on 30-dozen case equivalent. [3] Percent reported as shortage was replaced to determine grade. [4] Eggs reported as undersized and small end-up are also reported under other headings according to their quality.

REMARKS
Product meets contract requirements for Grade, condition, weight, size, and upside down eggs of DSA 135-71-M-U 306.
Note: Grader not present at time of loading.

I certify that in compliance with the regulations of the Secretary of Agriculture governing the grading of eggs, pursuant to the Agricultural Marketing Act of 1946, as amended, I graded at the time, and on the date stated above, the eggs described above, and the class, quality, size, and condition of said eggs, at said time and on said date, were as stated above

Kermit G. Putz
(OFFICIAL GRADER)

NOTICE OF BILL

Return pink copy of certificate with payment.

FEE . . . . Resident
EXPENSE . . . . ________
TOTAL . . . . ________

The amount indicated above is due and payable AT ONCE by money order, check, or draft. Payment should NOT be made in cash.

MAKE CHECKS PAYABLE TO: CONSUMER AND MARKETING SERVICE, USDA

MAIL TO: POULTRY DIVISION, C&MS
U.S. DEPARTMENT OF AGRICULTURE

This certificate is receivable in all courts of the United States as prima facie evidence of the truth of the statements therein contained.
This certificate does not excuse failure to comply with any of the regulatory laws enforced by the United States Department of Agriculture.

A8. The correct answer is "a. Must have been done by the USDA."

This is because 205 30-dozen cases total 6,150 dozen eggs and USDA grading at origin is required on shipments of 6,000 dozen or more.

Our next concern is the temperature of the delivery vehicle.

Read paragraph 2a beginning on page 7-16 of your Student Text.

Q9. On contracts of less than 400 cases, the vehicle must be precooled to what temperature? ______________________________

A9. There is no requirement on vehicle temperature for contracts of less than 400 cases. As you will see in a few minutes, however, there is a requirement on the temperature of the eggs themselves so the contractor will have to be concerned about the temperature of his vehicle even though we are not.

Next we should determine whether or not the eggs may have been damaged while in transit.

Read paragraphs 2b and 2c on page 7-17 of your Student Text.

Q10. In the event damage is noted, who arranges for the joint (government-carrier-contractor) inspection?

a. Carrier
b. DPSC
c. Destination authorities
d. Contractor

A10. The correct answer is "c. Destination authorities".

The carrier doesn't arrange for the joint inspection because naturally he had rather forget all about the damage. DPSC could arrange the joint inspection, but since the destination authorities are at the same location as the eggs, it is far simpler for them to do so. Further, destination authorities can easily see the actual condition of the eggs and can verbally inform the carrier on-the-spot right at the time the damage is noted.

Now what if you find that you did not receive the number of eggs called for by the purchase order?

Turn to page 7-17 in your Student Text and read paragraph 5.

Q11. What is the smallest number that would be acceptable on a purchase order which calls for 6,000 dozen?

a. 5,880 dozen
b. 5,700 dozen
c. Neither of the above

A11. The correct answer is "a. 5,880 dozen".

Since the purchase order is for less than 9,000 dozen, only a 2% variation in quantity is allowed.

What about packaging, packing, and marking requirements?

Turn to page 7-17 in your Student Text and read paragraph 6.

Q12. Where will you find special instructions pertaining to marking, etc., for a particular purchase order?

a. In DPSC clauses
b. Noted in the purchase order

A12. The correct answer is "b. Noted in the purchase order".

DPSC clauses list general requirements but those for a particular purchase order would be found in the purchase order itself. It might list them in detail or it might simply refer to other documents where they could be found in detail, thereby making these documents a part of the contract by reference. In either case, the particular purchase order that you are dealing with is the guiding factor.

Now we must select sample cases upon which to base our opinion of the entire shipment.

Turn to page 7-13 in your Student Text and read paragraphs 2, 3, and 4

Q13. How many sample cases would be selected from each of the following shipments?

a. 25 cases of large eggs

____

b. 250 cases of medium eggs

____

c. 300 cases of medium eggs

____

d. 250 cases of medium eggs and 50 cases of large eggs (300 cases total in one shipment)

____

175

A13. a. 3 sample cases

b. 11 sample cases

c. 11 sample cases

d. 11 sample cases of medium eggs plus 4 sample cases of large eggs (mixed grades and/or weight classes are considered as entirely separate lots).

Our next item to consider is internal egg temperature.

Turn to page 7-17 in your Student Text and read paragraph 4.

Q14. On the shipment of eggs that you are to receive (purchase order on page 5), the maximum temperature (lot average) at time of receipt should be no higher than

a. 70°F.
b. 60°F.
c. 50°F.

A14. The correct answer is "c. 50°F."

You will remember that we previously noted that on shipments of 400 cases or more, the vehicle had to be precooled to a temperature no higher than 50°F also. The maximum of 50°F internal egg temperature (lot average) applies on shipments of all sizes.

You should now determine case net weights.

Turn to pages 7-15 and 7-16 in your Student Text and read paragraphs 3, 4, and 5.

Work the problems on case net weights found on page 26, then check your answers on page 27. If you have any trouble, ask your instructor for assistance.

Q15. The following figures are the gross weights of 15 dozen eggs together with their flats and fillers. Determine the case net weight of each case.

a. 25.0 lbs

b. 26.0 lbs

c. 22.7 lbs

d. 24.6 lbs

Q16. The following figures are the gross weights of 15 dozen eggs together with their filler-flats. Determine the case net weight of each case.

a. 25.0 lbs

b. 24.0 lbs

c. 22.5 lbs

d. 21.2 lbs

A15.	a.	46.5 lbs	A16.	a.	48.0 lbs
	b.	48.5 lbs		b	46.0 lbs
	c.	41.5 lbs		c.	43.0 lbs
	d.	45.5 lbs		d.	40.0 lbs

You have now completed your inspection except for that portion which has to do with "quality determination" and completion of the remainder of the DD Form 1237, Report of Inspection of Shell Eggs.

Before we proceed with the actual quality determination, a review of egg formation and structure is in order.

Read all of sections B and C in the Student Text, pages 7-2 through 7-6, and be sure that you can identify all of the parts of an egg as shown in the upper diagram on page 7-34 of the Text.

The instructor will now show a film, "Formation of the Egg", which should prove to be both interesting and informative.

Read all of the material in section D, pages 7-6 through 7-10, of your Student Text. It is concerned with quality determination of edible eggs. Note very carefully the summary chart on page 7-32.

Now read all of section E, pages 7-10 through 7-13, of the Student Text. It is concerned with quality determination of abnormal eggs.

Look at the various "loss" eggs on display in the classroom. Become thoroughly familiar with the appearance of each kind.

Complete the following items on individual egg quality:

Q17. Shell clean and sound, normal in shape; air cell 1/8" deep, practically regular; white firm with a 3/16" diameter blood spot; yolk fairly well defined and practically free from defects. The overall quality of this egg is ______.

Q18. Shell clean and sound, slightly abnormal in shape; air cell 3/16" deep, practically regular; white clear and reasonably firm; yolk fairly well defined, practically free from defects. The overall quality of this egg is ______.

Q19. Shell sound with a few specks of adhering dirt, normal in shape; air cell 1/8" deep, practically regular; white clear, slightly weak; yolk well defined, slightly flattened. The overall quality of this egg is ______.

Q20. Shell clean and sound, practically normal in shape; air cell bubbly; white clear and reasonably firm; yolk fairly well defined and practically free from defects. The overall quality of this egg is ______.

Q21. Shell clean and sound, normal in shape; air cell 1/8" deep, practically regular; white firm with a 1/8" diameter blood spot; yolk slightly defined, practically free from defects. The overall quality of this egg is ______.

180

A17. Loss

A18. B

A19. Dirty

A20. B

A21. C

You are now faced with deciding "which individual eggs should I examine?"

Turn to page 7-13 of the Student Text and read paragraph 5.

Now how do you proceed with the actual candling of these eggs?

Turn to pages 7-19 and 7-20 in the Student Text and read paragraphs 2 and 3 for instruction on this task.

Read paragraph 4 on page 7-20 of the Student Text to learn how eggs of the various qualities are to be counted.

Now let's take a look at an eight-minute black and white movie which will show the procedures involved in candling eggs. It will also serve as a review of much of the material covered to this point and will afford you an opportunity to view the procedures to be followed.

Egg "candling" is a task that can be mastered only by gaining much practical experience. Our time in the classroom is too short to teach proficiency in this task, but we will take a short while to become acquainted (or reacquainted in the case of veterinary technicians) with the procedures involved.

Trays of eggs (pre-candled and sorted according to quality) have been placed at the various candling benches. You should examine enough eggs from each tray to satisfy yourself as to your ability to determine the quality of an egg by candling.

Ask your instructor for help if you need it.

After you have determined the quality of 100 eggs from each of your sample cases, the results are entered on the "worksheet" side of the DD Form 1237.

Read all of section K, pages 7-20 and 7-21, in the Student Text for guidance on how the various entries are to be made.

Enter the results shown below on the worksheet side of your DD Form 1237:

Sample Case #1: 46.5 lbs net weight, 75 As, 16 Bs, 5 Cs, 1 Check, 1 Underweight

Sample Case #2: 48.5 lbs net weight, 73 As, 11 Bs. 15 Cs, 1 Leaker

Sample Case #3: 47.5 lbs net weight, 78 As, 16 Bs, 6 Cs

Sample Case #4: 46.5 lbs net weight, 82 As, 10 Bs, 5 Cs, 3 Checks, 10 Underweights

Sample Case #5: 50.0 lbs net weight, 74 As, 24 Bs, 2 Cs

Check the entries which you have made against the answers shown on the back side of page 15.

Now that your results are entered on the DD Form 1237, you are ready to determine whether or not the shipment meets the requirements of the purchase order. To do this, we use subsection 213.4 of the DPSC Manual.

Pages 213.4.1 through 213.4.7 of this subsection contain detailed instructions on the use of the tables which follow on pages 213.4.8 through 213.4.11.

You will note that there are two separate tables:

Table I - Allowable Variation Limits (For Procurement Grade I Only) Applicable to Limited Verification Inspection at Destination

Table II - Allowable Variation Limits (For Procurement Grade I Only) Applicable to Double Verification Inspection at Destination

Ordinarily, destination inspections will be accomplished on the basis of limited verification.

Double verification will be used if any of the following conditions exist:

a. Case lot size is 100 or less.

b. Preliminary examination of lots of 10 cases or more indicate that excessive damage or deterioration may have occurred, but the need for the product is so urgent that the inspection is authorized (see paragraph 6c(2) on page 213.4.6 of the DPSC Manual for details).

c. In those instances of 200 cases or less where the contractor has authorized the vendor to perform his own origin inspection and grading.

You will also note that each table has A and B parts:

A. Requirement factors pertaining to formal review

B. Requirement factors not subject to formal review

These tables were devised by statistical means to allow a certain "leeway" from a stated set of requirements to account for human error, differences in interpretation, etc.

Note in part A of Table II that as the sample size gets larger, the allowable variation from the basic requirements gets smaller. This is because you are seeing more total eggs so your "statistical probability of error" is less.

Turn to pages 7-21 and 7-22 in your Student Text and read paragraphs 1 and 2 on destination verification inspection and use of the tables of allowable variation.

NOTE: THESE TABLES NOR THE FIGURES IN THEM ARE NOT TO BE RELEASED TO CONTRACTORS.

Check the results from your shipment (on your DD Form 1237) to see if they meet the requirements of the purchase order.

First of all, which table should be used? Since our lot size is 80 cases, we must use Table II (used for all lot sizes of 100 cases or less).

Now proceed to use the table as a checklist against the figures on your completed DD Form 1237.

Start down the left hand column (factor) of Part A of the Table and consider each item individually. The first item is "Grade A". Read to the right and you will find a basic requirement of 80% minimum. Your shipment had only 76.40% grade A eggs so it has failed to meet this basic requirement. You must now proceed further to the right until you come to the column headed "500" (the number of eggs you actually examined; 5 sample cases, 100 eggs/sample case). In this column, you will find 74.29%. This is the "allowable variation" for grade A eggs for a shipment with a sample size of 5 cases. Your shipment exceeded this latter figure so it is still acceptable for this particular factor.

Continue through Part A and Part B of Table II and check your shipment against the requirements for each factor.

Did you find any factors which failed to meet the basic requirement and the allowable variation? ______

If you did, list the factor, the basic requirement, and the allowable variation in the space below.

There were no factors for which your shipment failed to meet both the basic requirement and the allowable variation limit.

Now you are concerned with what to do with the completed report.

Read paragraph 2 on page 12-19 of the Student Text.

This inspection was a Class 4 (On Delivery At Purchase). What would your concern have been if this had been some other class of inspection such as a Class 6 (Prior To Shipment) or a Class 9 (In Storage)?

For guidance along these lines, read all of section L, page 7-21, in your Student Text.

Congratulations! So far as the actual inspection of eggs is concerned, you have covered all of the material. As we said earlier, however, proficiency will be gained only by practice of the task.

Other material to complete this block of instruction includes "Storage of Eggs" and "The Production and Inspection of Frozen and Dried Eggs". These units will follow in the classroom.

WORKBOOK 3ABR90830-VIII-1

DEPARTMENT OF VETERINARY MEDICINE

VETERINARY SPECIALIST

DAIRY PRODUCTS

August 1975

1-4

SCHOOL OF HEALTH CARE SCIENCES, USAF
SHEPPARD AIR FORCE BASE, TEXAS

Designed For ATC Course Use

DO NOT USE ON THE JOB

Department of Veterinary Medicine
School of Health Care Sciences, USAF
Sheppard Air Force Base, Texas 76311

WB 3ABR90830-VIII-1
August 1975

DAIRY PRODUCTS

OBJECTIVE

The student will be able to conduct inspections of dairy plants and products and determine compliance with applicable standards/specifications.

INTRODUCTION

The assigned reading material will describe and/or discuss manufacture of dairy products, cleaning and sanitizing of dairy plants and equipment, quality control programs, and basic procedures used in the inspection of dairy products. The use of this workbook will assist the student in gaining further insight into the relative importance of the material covered in conducting inspections of plants/products. It will also assist in relating the microbiological aspects of the raw products, the plant and equipment, and the finished products to the public health implications of consuming the finished products.

PROCEDURES

1. This workbook is yoursx to keep and may be used for future reference.

2. Your instructor will assign portions of the textbook chapter to be read and questions to be answered. He will also state a time and date to turn in your answers. The answers will be graded and returned to you. Work by yourself, and do not talk to your classmates while answering the questions.

PROBLEM 1

Exercise of study questions on the composition and properties of milk.

a. Answer all questions in the space provided.

b. The study questions are as follows:

This supersedes WB 3ABR90830-VIII-1, August 1974 and HO 3ABR90830-VIII-1, September 1974.

(1) What is the legal definition for milk? ______________________

(2) Why is colostrum excluded from the milk supply? ______________________

(3) What is the approximate composition of milk? ______________________

(4) Of what importance are fats and associated fat substances in milk? ______________________

(5) What protein is found only in milk? ______________________

(6) What is lactose and what results from the bacterial fermentation of it? ______________________

(7) What two minerals are abundant in milk and what is their function in the body? ______________________

(8) What is the importance of the phosphatase enzyme in milk?

(9) What is the importance of the lipase enzyme in milk?

(10) What is the pH of fresh milk? ______________________

(11) What is the importance of the freezing point of milk?

(12) Why is surface tension important when considering milk?

PROBLEM 2

Exercise of study questions on Dairy Microbiology and Public Health.

a. The study questions are as follows:

(1) Why is sanitation essential in the dairy field? __________

____

____

(2) What are the necessary growth factors microorganisms?

____

____

(3) Is milk drawn from healthy cows normally sterile? __________

____

____

(4) Classify bacteria according to their influence on the dairy field or dairy industry. __________

____

____

(5) What are the three classifications of bacteria according to their best growth temperatures? __________

____

____

____

(6) What importance are the milk souring organisms in relation to dairy bacteriology? __________

____

____

(7) What is the importance of coliform organisms found in raw milk? ______________________________

(8) What is the importance of coliform organisms found in pasteurized milk? ______________________________

(9) List several possible sources of contamination by coliform organisms after pasteurization of milk. ______________________________

(10) Why is milk cooled promptly at the farm? ______________________________

(11) Does pasteurization attempt to destroy all microorganisms? ______________________________

(12) Why is it unlikely to find molds in properly pasteurized milk? ______________________________

(13) What is the importance of mesophilic bacteria in milk? ______________________________

(14) What is the importance of thermoduric microorganisms in dairy products?

(15) What is bacteriophage and what is the importance of bacteriophage in the dairy industry?

(16) What are three diseases that may be transmitted from animal to man through milk?

(17) What are three diseases that may be transmitted from man to man through milk?

PROBLEM 3

Exercise of study questions on processed dairy products.

a. The study questions are as follows:

(1) What is meant by a concentrated fluid dairy product?

(2) What are four reasons for concentrating dairy products?

(3) Name four fluid concentrated dairy products.

(4) Which of the concentrated dairy products is the most common?

(5) What type of raw milk is used in the production of plain condensed milk?

(6) What are the functions of the hotwell?

(7) What are the three ways the fat, nonfat ratio may be standardized in concentrated dairy products?

(8) What are the main differences between concentrated whole milk and plain condensed milk?

(9) Why is concentrated milk usually condensed at a relatively low temperature and a high vacuum?

(10) What is the basis of preservation of sweetened condensed milk?

____

____

(11) What is the definition of evaporated milk? __________

____

____

(12) What is the major difference between evaporated milk and plain condensed milk? ______________________

____

____

(13) How is evaporated milk preserved? ______________

____

____

(14) What kind of can is evaporated milk usually filled into?

____

(15) How is the can sealed? ______________________

____

____

(16) What three things are cans tested for after they are filled and sealed? ______________________________

____

____

(17) Name two types of sterilizers. ______________

____

(18) What action should be taken if the evaporated milk inspected is found to have salt precipitation and is government owned? ______________

____

____

(19) What are two causes of fat separation? ______________

____

____

(20) What is the ideal storage temperature for evaporated milk?

____

(21) What is the purpose of turning evaporated milk? __________

____

____

(22) What may be added to evaporated milk? ______________

____

PROBLEM 4

Exercise of study questions on ice cream, sherbets and ices.

a. The study questions are as follows:

(1) What is the definition of ice cream? ______________

____

____

(2) What are sherbets? ______________

____

____

(3) What are ices? ______________

____

196

(4) What are the main ingredients used in the manufacture of ice cream? ______________________________

____

(5) List some of the milk products that may be used in ice cream

____

____

(6) What are emulsifiers? ______________________________

____

____

(7) Why are stabilizers added to ice cream? ______________

____

____

(8) May coloring be added to ice cream? ______________

(9) Why are liquid flavoring agents not pasteurized? ________

____

____

(10) Why is it necessary to sample pasteurized ice cream mix prior to addition of flavoring? ______________________________

____

____

(11) Why is homogenization of ice cream mix required? ________

____

____

224

(12) Name two types of ice cream freezers and their differences.

____

____

____

(13) What is the consistency of ice cream when it leaves the freezer? ________________________________

____

____

(14) What is overrun in ice cream? __________________

____

____

(15) Why are nuts and bulky fruits a good scurce [illegible] bacteria?

____

____

(16) When should the nuts and bulk fruits be added to the ice cream that is frozen in a continuous freezer? ________________

____

(17) Ice cream is judged on the basis of:

(a) ____

(b) ____

(c) ____

(d) ____

(18) Name three common flavor defects. ________________

____

____

(19) Name three texture defects. ________________________

____

____

(20) Name three body defects. __________________________

____

____

(21) What is the purpose of acidifying agents in the production of ices? ____

____

____

(22) Describe the sampling procedure of ice cream at destination. ____

____

____

PROBLEM 5

Exercise of study questions on butter manufacture.

a. The study questions are as follows:

(1) What is the definition of butter? __________________

____

____

(2) What is the approximate composition of butter? ________

____

____

(3) Why do creameries grade cream? ____________________

____

____

(4) What source of cream makes the best butter? ______________

____

(5) May creameries make first quality butter from second quality cream? ____

(6) Is cream, to which water has been added, illegal cream? ___

____

(7) Why will neutralization of the cream improve the shelf life of the butter? ____

____

____

(8) Give two reasons for pasteurizing butter. ______________

____

____

(9) When should the phosphatase test be performed on butter?

____

(10) What is the purpose of churning? ______________________

____

(11) What is the "break point" in the churning of butter? _____

____

____

(12) Why is butter washed in the churn? ____________________

____

____

(13) What is overrun in butter? ______________________________

____

____

(14) What is the difference between sweet butter and sweet cream butter? ______________________________

____

____

(15) What is printing of butter? ______________________________

____

____

(16) What is the significance of the mold and yeast count in butter? ______________________________

____

____

(17) What kind of product may result from underworking butter?

____

(18) List several possible sources of contamination of butter.

____

____

____

PROBLEM 6

Exercise of study questions on the classification and manufacture of cheese.

a. The study questions are as follows:

(1) What are the two general classifications of cheese? ______

(2) What are the types of natural cheese? ______

(3) What is the basis for the classification of natural cheese?

(4) What is the difference between natural and process cheese?

(5) What is the definition of cheddar cheese? ______

(6) What is a "starter" and what is its purpose in cheese making?

(7) What is rennet and what is its purpose in cheddar cheese making? ______

(8) If color is added to cheese, what is the requirement for it?

(9) Is unpasteurized milk allowed in the production of cheddar cheese? ________________

____

(10) After the curd has formed, why is it cut? ________________

____

____

(11) What is ditching? ________________

____

(12) Describe the two styles of packaging cheddar cheese. ________________

____

____

____

(13) What is meant by "Forced-Cured" cheese? ________________

____

____

(14) What information must be on the wrapper that goes around a piece of cheddar cheese? ________________

____

PROBLEM 7

Exercise of study questions on quality control of Fresh Dairy Products.

a. The study questions are as follows:

(1) What is the most important factor in the sampling of dairy products? ________________

____

(2) Under normal circumstances, how often should samples of milk be sent to the laboratory? ______

______

(3) What inspection procedures should be made on a product at base level? ______

______

______

(4) To what laboratory are samples of dairy products sent for routine analysis? ______

______

(5) To obtain accurate results at the laboratory, what temperature range must be maintained while the sample is in transit? ______

______

(6) How soon after sample collection should a sample be tested at the laboratory? ______

(7) What is the distribution of the laboratory form "Request for and Results of Tests?" ______

______

(8) To obtain a sample that can be used for court action (legal sample), who must have control of the product at the time of sampling?

______

(9) On which products is the Standard Plate Count not made?

______

______

(10) What would be the action of an inspector when the laboratory results showed an average milkfat content below that which is stated in the contract? ______

______

______

(11) What test is not routinely requested on fresh whole milk, unless there are suspicions of added water? ____________________

(12) What is meant by the "1-in-4" or "3 out of 4" when referring to coliform count? ____________________

____

____

(13) Why should a product record book be maintained? ______

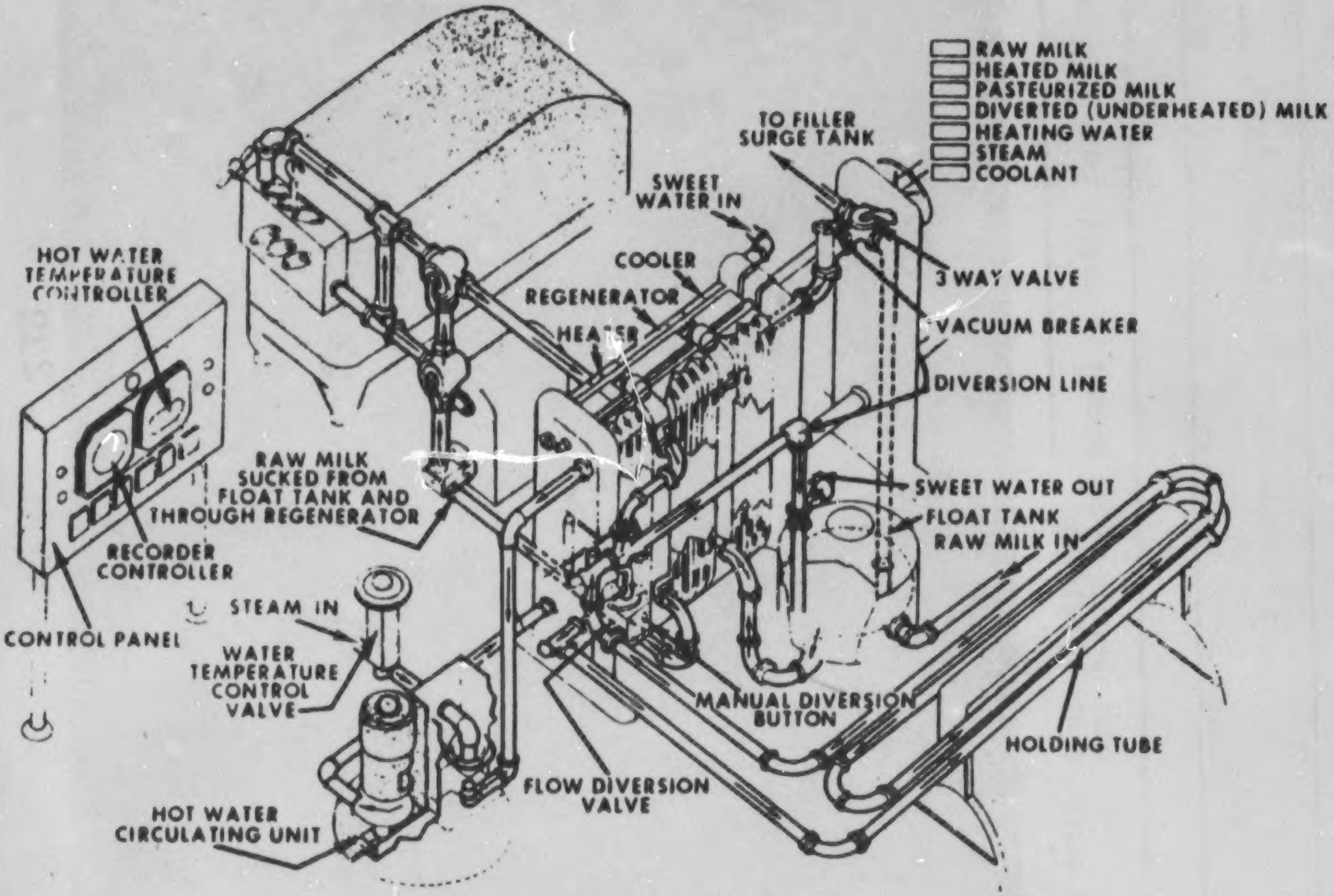
____

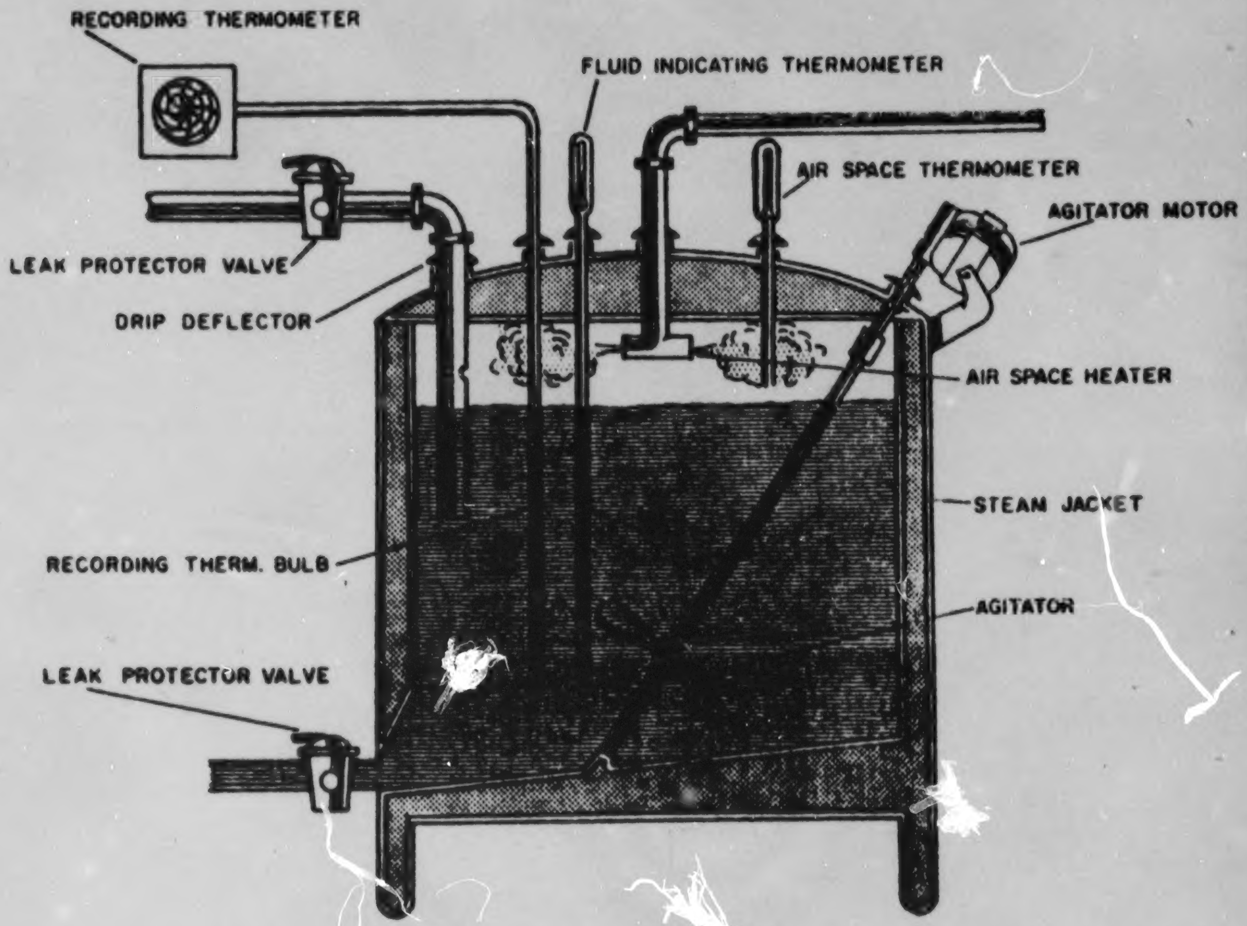
____

(14) What quantity of the product is usually taken when the milk is in quarts, pints or half pint? ____________________

____

HIGH-TEMPERATURE, SHORT-TIME PASTEURIZER





Vat Pasteurizer

207

STUDENT TEXT 3ABR90830-VIII-1
30BR9921-1-II-9

DEPARTMENT OF VETERINARY MEDICINE

VETERINARY SPECIALIST

DAIRY PRODUCTS INSPECTION

October 1974

1-4

SCHOOL OF HEALTH CARE SCIENCES, USAF
SHEPPARD AIR FORCE BASE, TEXAS

Designed For ATC Course Use

DO NOT USE ON THE JOB

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Department of Veterinary Medicine
School of Health Care Sciences, USAF
Sheppard Air Force Base, Texas

ST 3ABR90830-VIII-1
3OBR9921-1-II-9

DAIRY PRODUCTS INSPECTION

OBJECTIVES

During this block of instruction the student will be introduced to the basic inspection procedures of dairy products and quality control programs concerning dairy products. The text will expose the student to such areas as microbiology, public health, and processing techniques of dairy products, as well as cleaning and sanitizing of dairy equipment. This knowledge will enable the student to inspect dairy products for quality and wholesomeness factors in the interest of the government.

INTRODUCTION

This text deals with the facts involved in the inspection of dairy products. The student must understand these facts in order to become an effective dairy products inspector.

INFORMATION

DAIRY PRODUCTS INSPECTION

Milk and other dairy products are among the most important foods used in the armed forces. Let us consider the number of dairy products we consume in a day. If we had cereal for breakfast, we used milk or cream with it. If we had an omelet, we may have had cheese with it, and it may have been fried in butter. If we had eggs, they may have been fried in butter. If we had toast, we had butter with it. If we had hot cakes, the butter may have contained buttermilk or dehydrated milk. For our beverage, we may have had a glass of fresh milk, or coffee with cream, evaporated milk or dehydrated milk. For our noon meal, we may have had a cream soup, butter, cottage cheese salad, macaroni and cheese casserole, and fresh milk or cream with our coffee. For supper, we may have had fresh milk again, ice cream for dessert, and as a snack, we may have had a malted milk. Not only do we use dairy products directly in such ways as these, we also use them indirectly in such foods as pastries, breaded foods, and many other cooked foods. Milk, then, is a significant component of our daily diet. From a nutritional standpoint, it is "nature's most nearly perfect food." It is an excellent source of the calcium and phosphrous requirements in bone growth and tissue repair, and of protein, vitamins, and trace elements. Milk not only fulfills man's nutritional requirements, it also fulfills the growth requirements for many bacteria (germs). Because milk is an ideal food for bacteria, we must exercise control to insure that milk comes from healthy cows, that it is handled and stored in a satisfactory manner, that it is processed so that all of its harmful germs are killed, and that it is kept pure until it is consumed in Air Force dining halls. As a veterinary inspector, you are responsible for insuring that dairy products are pure and wholesome. This chapter will prepare you for this responsibility by providing information on processing methods, storage methods, quality control, grading, and inspection. The subjects are discussed in the following sections.

This supersedes SG 3ABR90830-IV, Jul 73

Section A - Introduction to Milk Inspection.

Section B - Microbiology and Public Health Aspects of Milk.

Section C - Processing of Fresh Fluid Milk and Bulk Milk.

Section D - Cleaning and Sanitizing Dairy Equipment.

Section E - Processing of Other Fresh Dairy Products.

Section F - Quality Controls and Inspection of Fresh Dairy Products, Including Bulk Milk.

Section G - Manufacture and Inspection of Ice Cream, Sherbets, and Ices.

Section H - Manufacture and Inspection of Processed Milks.

Section I - Manufacture of Dry Milk Products.

Section J - Manufacture and Inspection of Butter.

Section K - Manufacture and Inspection of Cheese.

SECTION A

INTRODUCTION TO MILK INSPECTION

Fresh milk is the basic ingredient of all dairy products. We not only drink it as a beverage, but we use it to make solids such as cheese, butter, and ice cream.

1. History of Milk. The history of cows and the care of milk dates back to Biblical times. Early Egyptian and Babylonian civilizations (2000 BC) reported using milk products. In these early civilizations, cows were worshipped and the butter made from the fat in their milk was used in religious ceremonies. Cheese was accidentally discovered when milk carried in pouches was agitated and soured. In the early history of our country, the Pilgrims suffered untold misery from starvation. There might have been less suffering if they had the foresight to bring milk cows with them when they came here on the Mayflower in 1620. Over half of the adults and all of the children who made this voyage from England died during the first winter. Other pioneers who followed the Pilgrims brought milk cows with them to use as a source of milk for children and as a source of power to till the soil. For every family, the family cow was a necessity. As communities began to develop and the population became urbanized, the family cow faded from the picture and dairy farms with many cows came into being. This increased preservation and transportation problems in providing a safe milk supply for consumers in the cities. Because milk is very perishable, it was necessary to refrigerate or preserve it. As concern developed over the transmission of diseases from cow to man through milk, it became necessary to put sanitary measures for cleaning pails and milk cans into effect. Today a large dairy industry has evolved which includes many dairy farms with cattle, modern equipment, and many types of plants which process many different dairy products.

2. Definition of Milk. Milk is defined as the substance produced by the mammary glands of mammals. The U.S. Public Health Service (USPHS) defines milk as the lacteral secretion, practically free from colostrum (lacteal secretion obtained immediately before and after calving) by the complete milking of one or more healthy cows. It contains not less than 8.25 percent solids-not-fat and not less than 3.25 percent milk fat.

3. Composition and Properties of Milk. The approximate composition of milk is: water - 86.9 percent; fat - 3.9 percent; protein - 3.2 percent; lactose - 5.1 percent; minerals - .9 percent; and vitamins, enzymes, gases, body cells, bacteria, trace elements, and other nitrogenous material.

a. Constituents of Milk:

(1) Water. Water is the major constituent of milk. It serves as a vehicle to hold the other components.

(2) Fat. There are two general types of milk fat - true milk fat and fat-associated substances.

(a) True milk fat is composed of fatty acids and glycerols. The fat is present as an oil-in-water emulsion. The cream line (fat on the surface) is caused by the attraction of fat globules to each other, agglutination, and gravity.

(b) Fat-associated substances are phospholipids, cholesterol, carotene, vitamin A, and vitamin D.

1. Phospholipids. These are fat-like substances containing phosphorus and nitrogen. They concentrate around fat globules and hold them in emulsion. They are highly susceptible to oxidative changes which can result in oxidized flavor in milk.

2. Cholesterol. This is a sterol. Together with vitamin D, it takes part in the metabolism of calcium and phosphorus.

3. Carotene. This is an orange-red crystalline pigment of carbon and hydrogen. It is a precursor of vitamin A. It imparts a yellowish color to milk, cream, and butter. The concentration of carotene is high in green grasses. When such grass is consumed by cows, the milk secreted is more yellowish in color.

4. Vitamin A. The diet of the cow influences the concentration of this vitamin in milk. Vitamin A is essential for growth, maintenance of the body, proper eyesight, and normal reproduction.

5. Vitamin D. This vitamin is essential in the metabolism of calcium and phosphorus for bone development, its content in milk is so minimal that 400 USP units are generally added to every quart.

(3) Lactose. Lactose is milk sugar; it provides the characteristic flavor of milk. Bacteria change it to lactic acid and other organic acids. The fermentation of this milk sugar produces an acid which coagulates casein to produce buttermilk, cultured milks, yogurt, and cheeses. Lactose is soluble in milk, but under certain conditions it may crystallize and cause sandiness in ice cream and condensed milk.

(4) Protein. The proteins in milk are casein and whey proteins.

(a) Casein. Eighty-five percent of the total protein in milk is casein. It is a complete protein because it contains all the known essential amino acids necessary for the growth and maintenance of the body. Casein is in colloidal suspension as calcium caseinate. It can be coagulated by lactic acid or rennet, or a combination of the two, and is the principal protein found in most cheeses. Most of the casein remains in the skim milk or serum portion when milk is separated.

(b) Whey Proteins. These are lactalbumin and lactoglobulin. They remain in the whey after the casein is removed. They are heat-sensitive and tend to change at pasteurization temperatures. When the proteins are exposed to high heat, they change to sulfhydryls. These sulfhydryls produce a cooked flavor and help to prevent other off-flavors caused by oxidation.

(5) Minerals. Two of the most important minerals in milk are calcium and phosphorus. Milk is deficient in iron, copper and manganese.

(6) Vitamins. Two important groups of vitamins found in milk are water-soluble vitamin B complex and ascorbic acid.

(a) Vitamin B Complex:

1. Thiamine. Absence of this vitamin may cause nervousness and eventual paralysis.

2. Riboflavin and Niacin. These vitamins are necessary for body growth.

3. Pyridoxine (Vitamin B_6). This vitamin keeps the lips and the corners of the mouth from cracking.

4. Pantothenic Acid. This vitamin helps to prevent pellagra.

5. Biotin. This vitamin is necessary for normal skin and intestinal development.

6. Folic Acid. This vitamin helps to prevent anemia.

7. Vitamin B_{12}. This vitamin is essential for normal fat metabolism.

(b) Ascorbic Acid (Vitamin C). This vitamin prevents such skin disorders as scurvy.

(7) Enzymes. These are protein-like substances which can accelerate or retard chemical reactions. Seven important enzymes found in milk are: phosphatase, lipase, catalase, peroxidase, lactose, amylase, and galactase.

(a) Phosphatase. The same period of time and the same temperature necessary to pasteurize milk destroys this enzyme. The efficiency of pasteurization can be determined by testing for the by-product of this enzyme.

(b) Lipase. This enzyme is present in raw milk and has the ability to split fat (triglycerides) to produce free fatty acids which can cause rancid flavors. Milk which is homogenized and which is not given heat treatment may develop a rancid flavor because of the lipase enzyme.

(8) Dissolved Gases. As milk comes from a cow, it contains about 8 percent of dissolved gases by volume. These gases are carbon dioxide, oxygen, and nitrogen.

(9) Bacteria. These are always present when milk is drawn from a cow.

(10) Body Cells. Cells from the udder and white blood cells are usually found in milk. The health of the cow and the physical condition of her udder affect their number.

(11) Nitrogenous Material. Ammonia, urea, amono acids, and uric acid are included in nitrogenous material.

b. Properties of Normal Milk. The properties of milk can be described best in terms of acidity, color, flavor, and odor, specific gravity, stickiness, surface tension, and viscosity.

(1) Acidity. Acidity is expressed in terms of pH (hydrogen ion concentration). Milk, as drawn from a healthy cow, has a pH of 6.5-6.7. This is normal acidity. Total acidity, as expressed in a laboratory report, is normal acidity plus developed acidity. Developed acidity is caused by bacteria acting on lactose to produce lactic acid.

(2) Color. The normal color of milk varies from light cream to light bluish-white. Milk with a high fat content and high carotene contene content is more creamy in color. Other constituents which affect the color of milk are casein, salts, and riboflavine.

(3) Flavor and Odor. Milk is examined for off-odor more often than it is e examined for any other factor. The reason for this is that many inspectors object to tasting milk, especially raw milk, since doing so would expose them to the danger of contracting a milk-borne disease. Properly pasteurized milk can usually be tasted safely. Milk odor can be checked by smelling a can or carton of milk as soon as it has been opened. Normal milk has a pleasant odor and a sweet lactose flavor.

(4) Specific Gravity. The normal specific gravity of milk varies from 1.027 to 1.035, with an average of 1.032 at 60°F. An instrument called the lactometer is used to determine specific gravity. Specific gravity is determined for the purpose of detecting whether the milk has been grossly adulterated with water. The test can also be used to estimate solids-not-fat and total solids in milk.

(5) Stickiness. Lactose and casein in milk make it sticky. This stickiness complicates utensil cleaning procedures on farms and in dairy plants.

(6) Surface Tension. Surface tension is the ability of a substance to form a drop of globule. Milk has a lower surface tension than water. In order to clean milk utensils properly, substances known as wetting agents must be added to water. These wetting agents reduce surface tension and allow cleaning solutions to penetrate adhering milk solids.

(7) Viscosity. The fat emulsion and colloidal particles in milk make it viscous. It has a resistance to flow in a tube and will not flow in a line with the same velocity as water. This property must be considered when the holding time of a high-temperature, short-time (HTST) pasteurizer is tested.

SECTION B

MICROBIOLOGY AND PUBLIC HEALTH ASPECTS OF DAIRY PRODUCTS

Microbiology is the science which deals with the study of microorganisms, including bacteria and molds. In this section, we will discuss bacteriology, the science which deals with bacteria, and public health aspects of dairy products.

4. Bacteriology. Bacteria in milk are of concern because of their beneficial and harmful effects. Some types of bacteria can influence desirable flavors and characteristics of such dairy products as buttermilk and cheese. Others can create undesirable spoilage, off-flavors, and off-odors. Others are pathogenic (disease-producing) and can be responsible for such diseases as tuberculosis, typhoid fever, and septic sore throat. A fourth type of bacteria is neither beneficial nor detrimental, but it increases the total bacteria count of a product and can be responsible for a product being rejected for failing to meet quality standards.

a. Bacterial Growth Phases in Milk. The phases of bacterial development are the lag, growth, stationary, and death phases.of bacterial development

(1) Lag Phase. The lag phase is the time it takes bacteria to adjust to their environment. There is little, if any increase in their numbers. Some bacteria characteristically have a long lag phase while others may remain in this phase for only a few hours.

(2) Growth Phase. The growth phase is significant because bacteria increase in great numbers during this stage. If pasteurization followed by refrigeration can take place at the beginning of this phase, the total numbers of bacteria will be reduced.

(3) Stationary Phase. During the stationary phase, the number of old bacteria dying equals the number being produced.

(4) Death Phase. During the death phase, bacteria die at a rate that is greater than the rate at which new bacteria are produced.

b. Classification of Bacteria. Bacteria may be classified according to optimum growth temperatures. The four classifications are psychrophilic, mesophilic, thermoduric, and thermophilic.

(1) Psychrophilic Bacteria (Psychrophiles). The psychrophiles are cold-loving bacteria which grow best at low temperatures (32° to 86° F.), with optimum growth at 68° F. They are killed at normal pasteurization temperatures, but when they are present in the environment, they are a source of contamination for either raw or pasteurized milk. Their presence in pasteurized milk in the milk cooler, cold-milk lines, cold-milk storage tanks, and other equipment which involves the storage or handling of cold milk indicates poor sanitation practices. These bacteria may cause defects in raw or pasteurized milk, e.g., their growth may cause undesirable flavors to develop or keeping quality to decrease. An introduction of the farm bulk milk tank, with less frequent pickups of raw milk on the farm (every 2 to 3 days), has caused an increased problem with the growth of these bacteria.

(2) Mesophilic Bacteria (Mesophiles). These are medium-temperature-loving bacteria, which have a growth temperature range of 50° to 113° F. with optimum growth at about 98° F. (approximately body temperature). Milk temperature, as drawn from the udder, approximates the cow's body temperature of 101° F. If milk cannot be delivered to the receiving station or dairy plant within 2 hours after it has been drawn from the udder, it must be cooled to 50° F. or below to prevent bacterial growth and to keep staphylococcus toxin from forming. All known pathogenic bacteria are mesophiles, but all mesophiles are not pathogenic.

(3) Thermoduric Bacteria (Heat-Resistant Mesophiles). Great numbers of thermoduric bacteria in raw milk will cause high counts in the pasteurized milk. HTST pasteurization at 161° F. for 15 seconds is much more effective than vat pasteurization at 145° F. for 30 minutes, in destroying thermoduric organisms. Inadequate sanitary practices on the farm (such as improperly cleaned and sanitized milking machines) are the most common reasons that thermodurics are present in raw milk. Inadequate cleaning and sanitizing at the pasteurization plants may also cause thermoduric contamination of milk. These bacteria may be detected in the laboratory by pasteurizing the sample and by doing a standard plate count.

(4) Thermophilic Bacteria (Thermophiles). These heat-loving bacteria grow at high temperatures (104° to 162° F.); optimum growth takes place at about 125° F. A Although thermophilic bacteria have not been shown to be a pathogenic, they are objectionable in milk because they: (1) grow rapidly at vat-pasteurization temperatures; (2) are causative agents of off-flavors; and (3) produce a high acidity and a tendency

for the milk to curdle upon heating. Because the incubation temperatures are below the optimum growth temperatures of thermophiles, they usually occur as "pinpoint" colonies on plates incubated at standard plate count temperatures. Thermophilic bacteria are most readily detected by incubating plates at 131° F. (55° C.) for 48 hours.

c. Microorganisms Common to Dairy Products:

(1) Lactic-Acid-Producing Bacteria (Milk-Souring Bacteria). These bacteria acquired their name because of their ability to convert lactose (milk sugar) into lactic acid. At normal temperatures (60° - 90° F.), they grow rapidly and produce enough acid to inhibit the growth of many other genera:

(a) Streptococci (Chain, Shperical-Shaped Bacteria). Strep, lactis and Strep. Cremoris, the most common organisms concerned with the normal souring of milk, are used as starters in the manufacture of cheddar cheese, butter, and cultured buttermilk. Strep, agalactia is the primary cause of mastitis in cattle in many parts of the United States. Strep, thermophilus, a heat-resistant organism, grows at temperatures up to 127° F., and is used as a starter for Swiss cheese.

(b) Lactobacilli (Rod-Shaped Bacteria). These organisms may produce up to 4 percent developed acidity in milk. They may continue to sour milk after the streptococci have produced their approximate limit of 1 percent developed acidity. L. casei, common in raw milk, is important in the ripening of cheese. L. acidophilous is used in the production of acidophilus milk, which is recommended for certain intestinal ailments. L. bulgaricus is used as a starter in the production of Bulgarian milk.

(2) Staphylococci. Staphylococci are commonly found in milk which has been aseptically collected. Some species are thermoduric and survive pasteurization temperatures. Several varieties are pathogenic and cause boils and wound infections in man, and mastitis in cattle. Staph. pyogenes var aureus is a common cause of bovine mastitis It and other varieties are capable fo producing a heat-stable enterotoxin (biological poison), a common cause of food poisoning in humans. Because toxin withstands temperatures of pasteurization or higher temperatures, our control measures must be directed toward inhibiting growth and toxin formation by refrigerating the milk.

(3) Spore-Forming Bacilli (Rod-Shaped Bacteria). These organisms are usually found in the soil. Their presence in milk usually indicates contamination with soil from the hair of the cow, dust in the milking barn, or dirt on the milk-handling utensils. The spores are highly resistant to heat, and pasteurization temperatures do not generally kill them. High bacterial counts in pasteurized products are often caused by heat-loving or heat-resistant species. The most common species found in milk are: B. subtilis (the "hay bacillus"), which is common in barn lots; B. coagulans, which may cause spoilage in evaporated milk; and B. cereus, var. mycoides. Most milk contains spores of the latter organism, but conditions are seldom favorable to their growth. This organism is the chief cause of "sweet curdle" in low-acid milk, since it produces a rennet-like enzyme.

(4) Non-Spore-Forming Bacilli. Several genera of bacteria in this group are important in the dairy industry.

(a) Alcaligenes Viscosus. Certain strains of this bacilli may cause viscous or ropy milk.

(b) Pseudomonas Group. These bacilli are capable of growing at refrigeration temperatures and can break down fat and protein, thereby creating a rancid, putrid product. Several species can produce color changes in milk and cream. For example, Ps. syncyanea causes a blue discoloration in milk; Ps. synxantha produces a yellow discoloration in cream; and Ps. nigrifaciens causes a black to reddish-brown discoloration.in butter

(c) Proteus Group. P. vulgaris is the most common species in this group. All of the bacteria have the ability to break casein down into water-soluble, bitter-flavored products.

(5) Coliform Bacteria. The coliform bacteria are significant in dairy sanitation. In high numbers, they indicate faulty sanitation.

(a) Characteristics. These short, rod-shaped organisms, which are facultative anerobes, are non-spore-formers and convert lactose to gas and acid. The most common species are Escherichia coli, and organism common to the intestinal tract of man and animals; and Aerobacter aerogenes, an airborne organism derived primarily from the soil and from grains.

(b) Sources. Nearly all raw milk contains coliform organisms; if raw milk handled under ordinary conditions lacks these organisms, there are grounds for suspecting that agents were added to the product to destroy them. However, their presence in large numbers may indicate the following insanitary conditions and practices.

1. Presence of dirt and manure from animals in milk or milk contai containers.

2. Dust in and around the barn. A high coliform count may occur in pasteurized milk because:

a. Condensates drip directly into the product.

b. Construction work is underway in the plant at the time of processing.

c. Containers are improperly covered.

d. Equipment, piping, or utensils have been cleaned and sanitized improperly.

e Bottles or bottle caps are contaminated.

f. Employees who handled the milk or equipment failed to practice good personal hygiene.

A few coliform bacteria surviving pasteurization may produce a high coliform count if there is improper cooling or high storage temperature. Since surviving coliform bacteria multiply faster than other milk-borne bacteria at temperatures between 45° - 50° F., it is important to remember that while [illegible] product may comply with the specification requirement at the time it is pasteurized, it may not do so 48 hours later if it is held at temperatures approaching 50° F.

(6) Yeasts. Yeasts are similar to bacteria in structure and methods of cultivation. They are much larger than bacteria (10 to 15 microns, as compared with 1 to [illegible] microns), and are usually destroyed at pasteurization temperatures. Yeasts can tolerate rather high acidities (pH 3.5). They use lactic acid for energy; when milk with high initial acidity is contaminated with yeasts, the acidity diminishes. Certain species of yeast may cause gassiness in sweetened condensed milk because of their strong fermentative and oxidative abilities to metabolize carbohydrates. Yeastiness is common when old cream is used to make butter, and this flavor often carries over to the butter. Yeasts in cheese produce a yeasty flavor and also causes a characteristic flat, elongated gas hole to develop. This condition is called "slittiness," "slit-eyes," or "fish-eyes."

(7) Molds. Geotrichum candidum, a common mold of milk, is the only species considered important as a contaminant in milk. The mold is usually introduced from contaminated barn areas. It grows best at 86° F., but it is easily destroyed at pasteurization temperatures. Penicillium roqueforti and P. camemberti are the molds responsible for the characteristic flavor and appearance of Roquefort and Camembert cheeses, respectively.

(8) Bacteriophages. These are considered to be virus-like agents which have the ability to destroy living bacterial cells. Bacteriophages are detrimental to the dairy industry when they destroy beneficial organisms used to create such milk products as cottage cheese and buttermilk. A reduced rate of acid production or a lack of curd formation may indicate the presence of bacteriophages. However, these conditions may not be solely due to the presence of bacteriophages, but to the poor condition of the starter, improper "setting" temperatures, or antibotic or chemical agents. Bacteriophages are not easily destroyed by pasteurization, but they may be effectively destroyed by chlorine and quaternary ammonium compounds. In dairy plants where bacteriophages are isolated, all surfaces should be cleaned thoroughly and sprayed with a chlorine solution.

d. Detecting Bacteria in Dairy Products. It is impossible to determine the exact number of bacteria in a sample of milk; bacterial counts are only estimates at best. Official methods of conducting bacteriological tests on milk are contained in the American Public Health Association publication, Standard Methods for the Examination of Dairy Products.

5. Public Health Aspects of Dairy Products:

a. Importance. As noted earlier in this chapter, milk is not only man's most nearly perfect food, but it is also a good nutrient for bacteria. When bacteria are held at suitable temperatures in milk, they multiply rapidly. When bacteria increase in milk, their ability to infect individuals who drink the milk is greatly enhanced. Basically, improper handling of dairy products is the greatest single factor involved in the transmission of milk-borne diseases to consumers. The military services require that high-quality milk be used in troop-feeding programs. It is essential, therefore, from a health standpoint, as well as from the standpoint of the economic and morale factors involved, that milk and other dairy products procured for the military services meet certain general requirements. These requirements are that the product shall be:

(1) Free from pathogenic bacteria.

(2) Free from harmful substances (such as antibiotics, biologicals, and chemicals) or toxic substances.

(3) Clean and free from extraneous materials.

(4) Normal in composition.

(5) Low in bacterial count.

(6) Good in flavor.

(7) Good in keeping quality.

(8) Originated from approved sources.

b. Milk-Borne Diseases:

(1) Bovine Tuberculosis. The eradication program for dairy cattle has greatly reduced bovine tuberculosis among animals and humans in this country. Studies made in the early 1900s indicated that about 7 to 10 percent of human tubercular cases were of bovine origin. The organism, Myocabacterium tuberculeum var bovis may enter milk through lesions in a cow's udder. In many countries, a high incidence of tuberculosis exists in milk cows, and it is difficult to find a wholesome milk supply. Rates of infection as high as 70 percent have been found in dairy cattle in overseas areas. Safe milk supplies in oversea areas have been attained by developing a central area free from tuberculosis. This central area is maintained by testing and paying farmers premiums for milk from tuberculosis-free herds. Buffer zones around the free areas are usually maintained by testing and restricting the movement of cattle. These programs are successful if the local government veterinarians assist and cooperate with U.S. armed forces personnel.

(2) Brucellosis. This disease is acquired by drinking milk obtained from infected animals and by handling infected animals and meat products. Cattle are infected by Brucella abortus, sheep and goats by Br. melitensis, and swine by Br. suis. This disease is also referred to as Bang's disease, Malta fever, and undulant fever. Active State and Federal eradication programs in this country are trying to eliminate the disease. Outside the CONUS, the military veterinary services have developed programs for coping with this disease which are similar to those adopted in the control of bovine tuberculosis.

(3) Q Fever. The main route of Q fever infection is the lungs. It develops when the organisms, Coxiella burneti, is inhaled. Drinking of infected milk may increase antibody titers. To prevent ingestion of the organism in milk, the USPHS has recommended that the temperature be 145° F. or above, during vat pasteurization. Outbreaks of this disease have occurred among military personnel after troops were billeted near infected animals, after they have slept on infected hay, and as a result of laboratory "accidents."

(4) Leptospirosis. This disease, which may be shed in milk, is caused by the Leptospira species in cattle and other animals.

(5) Anthrax. The organism Bac. anthracis, is not usually transmitted to humans through milk because animals infected with anthrax stop producing milk. However, spores can enter milk or milk equipment via dust, wind, and those who handle milk or milk equipment.

(6) Rabies. There is little danger of the milk of a rabid cow infecting a human since this virus does not enter her udder until she is moribund.

(7) Mastitis. Mastitis, an infection of the udders, can be caused by a multitude of bacterial species. Organisms of human importance are those causing septic sore throat, scarlet fever, and staphylococcus infections. Streptococcus and staphylococcus organisms have been involved in specific food poisoning and in fectious outbreaks. Examples are staphylococcus toxin in cheese and dried milk, and streptococcus infection from bakery goods.

(8) Other Diseases. Numerous diseases which rarely occur in humans may be caused when milk from infected animals is consumed. Foot-and-mouth disease, actinomycosis, and Haverhill fever are diseases which are caused by drinking milk from infected animals. Human diseases such as typhoid, paratyphoid, streptococcal infections (septic sore throat and scarlet fever), diphtheria, cholera, amebic dysenteries, and other intestinal disturbances may be transmitted from person to person via milk.

c. Sanitary Controls. An effective sanitary control program against the spread of milk-borne disease is based upon the establishment and enforcement of sanitary standards; the education of producer, processor, and consumer in the essentials of a safe milk supply; and an efficient inspection, which includes a laboratory testing program.

(1) Sanitary Standards. Sanitary standards for dairy products must be followed in the production, processing, and distribution of dairy products. The following documents contain the recognized principles of sanitation for dairy plants in general:

(a) Directives issued by the Surgeon General; military standards; and technical medical bulletins.

(b) The USPHS Grade A Pasteurized Milk Ordinance.

(c) The Diary Division, Agricultural Marketing Service, USDA, publication, Minimum Specifications for Approved Plants Manufacturing, Processing, and Packaging Dairy Products.

(d) Industry sanitary standards, such as those of the Evaporated Milk Association or the American Dry Milk Institute.

(2) Enforcement of Sanitary Standards. In the armed forces, sanitary standards are enforced through inspections of milk supplies by military veterinary officers and through purchasing these supplies only from processors whose names appear in the Directory or are listed in the "USPHS Interstate Milk Shippers List" with a sanitary compliance rating of 90 or more. Municipal and local agencies provide most civilian enforcement. USPHS recommends that its Grade A Pasteurized Milk Ordinance be used in dairy establishment inspection. Local governmental agencies adopting this code, or codes of their own, have responsibility for enforcement. State governmental agencies usually coordinate the enforcement of the adopted code among municipalities and local governments. Other Federal agencies assisting in milk control are:

(a) The Animal Disease Eradication Branch, USDA, which regulates interstate shipment of dairy cattle, with special attention to the elimination of unhealthy animals.

(b) Food and Drug Administration, U.S. Department of Health Education and Welfare. This agency formulates definitions for many dairy products and maintains surveillance of interstate shipments of unwholesome or adulterated dairy products.

(c) U.S. Department of Health, Education, and Welfare, through the U.S. Public Health Service. This agency controls milk supplies that are intended for consumption on interstate carriers. It also assists state, county, and municipal governmental agencies to rate and certify milk supplies and to certify milk-testing laboratories.

(3) Providing a Safe Raw Milk Supply. To provide a safe raw milk supply, certain minimum sanitary requirements must be met.

(a) Healthy Cattle. Herds supplying milk on military contracts must be in accredited areas under USDA supervision. Cows must be free of tuberculosis, Brucellosis, mastitis, and other diseases.

(b) Facilities. The following maintenance facilities will be strictly adhered to:

1. The milking barn must be properly ventilated, cleaned, and lighted.

2. The adjoining cow yard must be reasonably clean.

3. The milk house must be properly constructed, clean, and sanitarily equipped.

4 Manure disposal facilities must not be a source of flies and contamination.

5. Toilet facilities must be adequate enough to keep disease from spreading.

(c) Water Supply. The water supply will be potable and protected.

(d) Cooling. Methods of cooling which protect the quality of the product and prevent bacterial growth must be used.

(e) Utensils. Utensils, of sanitary construction and design, will be kept clean at all times. They can be kept sanitary by retreating them with bactericides, and by handling and storing them properly.

(f) Personnel. Persons who work with dairy products must be healthy and free of any disease that is transmissible to cows or to consumers. They should practice strict personal hygiene and clean habits when they handle dairy products.

(4) Providing a Safe Pasteurized Milk Supply. To provide a safe pasteurized milk supply, certain sanitary conditions must prevail.

(a) Raw Milk. Only safe, wholesome raw milk which is produced and handled under sanitary conditions is used.

(b) Personnel. Most dairy plants require prospective workmen to take preemployment physical examinations. Strict surveillance is maintained over employees. They are not allowed to handle any product or equipment while they are ill or in a condition that would contribute to the transmission of an infection. Physical examinations are not always conclusive because carriers cannot always be routinely detected with reliability; because medical examinations may not always be thorough; and because specimens may not always show as positive in laboratory examination, even though the examinee has a disease. Good health education programs probably contribute to controlling the transmission of disease more than any other factor.

(c) Building and Facilities. The following physical facilities will be provided:

1. A soundly constructed building located in sanitary surroundings; designed so it can be easily cleaned; built so it prevents the entrance and harborage of insects, rodents, and other animals; properly lighted and ventilated; and floors which are smooth and easily drained.

2. Primises which are reasonably clean, well-drained, and free of debris that would provide harborage for rodents and insects.

(d) Sanitary Equipment, Utensils, and Supplies. Equipment, utensils, and supplies will be of sanitary design and construction, and in good repair. When they are not in use, they will be properly located and stored, and adequately protected. Before equipment and utensils are used, they will be cleaned and treated with bactericides.

(e) Water Supply. The water supply must be safe, wholesome, potable, and conveniently available in sufficient amounts to keep the plant sanitary.

(f) Waste. Waste will be disposed of in a sanitary manner to keep the premises, facilities, equipment, and products from becoming contaminated.

(g) Methods. Methods of cooling, bottling, and packaging will be used which protect the products from contamination and prevent bacterial growth.

(h) Pasteurization. Pasteurization which will assure compliance with time and temperature requirements must be performed in approved equipment. Pasteurizers, sterilizers, and other dairy equipment will have the mechanical controls necessary to insure compliance with processing requirements.

SECTION C

PROCESSING OF FRESH FLUID MILK AND BULK MILK

In this section, we will discuss milk plants, 3-A sanitary standards, and processing.

1. Milk Plants:

a. Types of Milk Plants. There are several types of milk plants:

(1) Collecting Station or Country Receiving Station. At these plants, raw milk is received from the farm, weighed, sampled, cooled, and stored pending transportation to the pasteurization plant. Years ago collecting stations were necessary because it was impracticable to haul cans of milk several hundred miles to large pasteurization plants.

(2) Direct from Farm to City Pasteurization Plant. The development of the farm bulk tank method of handling milk made the collecting station unnecessary; today milk may be hauled directly from the farm to the city pasteurization plant. Most dairy plants in the United States - particularly those in small cities or towns - operate as processing plants with receiving facilities. We will discuss this type of plant in this manual.

(3) Other Milk Products Plants. Some plants produce butter, cheese, dried milk, evaporated milk, condensed milk, or sweetened condensed milk. They are usually located in areas where there is a potential surplus of milk. Most of the processing at these plants takes place in the spring when there is a surplus of milk. Some of these plants which manufacture other milk products may also process grade A fluid milk. Other milk products are usually produced from a manufacturing grade milk, whereas grade A fluid milk must meet all the standards for grade A processing. When a plant processes both milk products from manufactured milk and grade A milk products from grade A milk, ordinances usually require that processing facilities be completely separated.

2. 3-A Sanitary Standards. A document known as the 3-A Sanitary Standards, provides desirable standards for the design, construction materials, and capabilities of milk plant equipment. This document was formulated jointly by the International Association of Milk, Food and Environmental Sanitarians, Inc. (Shelbyville, Ind.), the USPHS, and the Dairy Industry Committee. Before these standards were developed, milk plant equipment varied to some extent in accordance with the views of individual sanitarians. As a result, milk plant managers and manufacturers of milk plant equipment were confused when it became necessary for them to meet the requirements of more than one sanitarian. A committee, the 3-A Sanitary Standards Committee, was established to represent the viewpoints of public health officials, milk processors and producers, and milk equipment manufacturers.

3. Processing:

a. Dairy Farm to Milk Processing Plant:

(1) The majority of dairy farms today have bulk milk tanks in which one to several days' production of raw milk can be stored prior to shipment to the processing plant. These tanks are usually made of stainless steel and are easily cleaned and sanitized. They are refrigerated to assure the raw milk temperature is lowered to and maintained at no more than 50° F.

(2) Prior to pickup, each farm's raw milk is sampled by the bulk tank truck driver for temperature determination and subsequent testing at the processing plant. The raw milk is then pumped from the farm bulk tank to the tank truck for delivery to the plant. The farm bulk tank is then cleaned and sanitized.

(3) Samples of the raw milk in the bulk tank truck are usually taken upon arrival at the processing plant. The raw milk is again checked to ascertain that the temperature is not more than 50° F. and then it is transferred from the truck to raw bulk storage tanks within the plant. The tank truck is cleaned and sanitized following emptying.

b. Sanitary Piping Equipment Requirements. Since fluid dairy products are usually conveyed from one piece of equipment to another in pipes, pipe fittings, gaskets, and valves must meet the criteria of 3-A. Sanitary Standards for dairy fittings. The piping should be as short and direct as possible and constructed so that it is easy to clean. Pipes should be made of stainless steel, glass, plastic, or equally corrosion-resistant, nontoxic, and nonabsorbent material. V-type threads should not be used on sanitary pipes and fittings. Gaskets, which can be easily cleaned, may be of the single-service type, or of removable rubber or plastic types. Gaskets used at pipe joints should not be recessed nor should they project above the milk-contact surfaces. Sanitary valves are usually made of stainless steel or rubber-coated stainless steel.

(1) Equipment in Milk-Contact Areas. According to 3-A Sanitary Standards publication, equipment will be free of sharp corners and broken areas on milk-contact surfaces. The material on milk-contact surfaces should be smooth, and of stainless steel or other equally smooth material. It must be designed to facilitate cleaning and inspection by making areas of sanitary importance easily accessible. Sanitary or acme-type threads will be used on pipelines and in milk-contact areas; properly constructed lids or covers must protect the product.

(2) Construction Material. Material used in the construction of piping equipment must be nontoxic, nonabsorbent, corrosion-resistant, and easy to clean.

(3) Milk Pumps. The three types of sanitary milk pumps are the centrifugal pump, the piston-type displacement pump, and the rotary-type displacement pump. Each must be designed to permit easy disassembly and cleaning. Fitting should be tight, to prevent leakage.

(a) Centrifugal Pump. This pump has a vaned rotating propeller. While it is a high-speed pump, it does not build up dangerous pressures as displacement-type pumps do. Since it is more durable and more economical to operate than the rotary-type pump, it is the most popular pump used in dairy plants. A disadvantage of the centrifugal pump is that it occasionally churns whole milk and sometimes breaks down the body of buttermilk.

(b) Piston-Displacement Pump. Since this pump delivers a uniform flow of milk, it may be used as a timing pump. Its actions are similar to the actions of pistons in a motor. The homogenizer is an example of a piston-placement pump.

(c) Rotary-Type Placement Pump. This type of pump can be timed accurately and can be used to control the flow of milk through the HTST pasteurizer. The impellers are precision-made to fit the pump chamber, thus allowing the same quantity of milk that enters on one side to flow out on the opposite side of the pump. These impellers can build up dangerous pressures and cause damage. For example, if a valve is closed ahead of this type of pump, something must break gears, pumphousing, or pipes.

(4) Milk Filters. Milk filters are usually constructed of a series of disks with alternating filter pads. They may be of the dual type; this makes it possible to clean one filter while the other one is in use. Milk is filtered by passing it through the filter pad; this eliminates any sediment which it may contain.

(5) Milk Clarifiers. The purpose of the clarifiers is to remove the heavier sediment particles by centrifugation. The clarifier consists of an enclosed bowl and cone-shaped disks which rotate rapidly, causing a centrifugal force toward the outside of the bowl. This can be done with either cold or warm milk. Cold clarification is usually conducted during the receiving operation; warm clarification is usually done during the pasteurization process as milk enters the bowl and the centrifugal force deposits the heavier particles of dirt and white blood cells on the wall of the bowl. This accumulation of dirt and cells is called slime. The amount of slime or foreign material deposited in the clarifier depends upon the cleanliness of the milk that arrives from the farm, how long the machine is in continuous use, the speed of the machine, and whether warm or cold clarification takes place.

(6) Milk Coolers. Milk may be cooled in batch-type coolers or in continuous-type coolers.

(a) Batch-Type Coolers. The farm bulk tank is an example of the batch type milk cooler. In this type of cooler, the milk is cooled inside a vat or tank. The coolant is circulated in pipes, as in the coil vat or in the jacket of the tank. The 3-A Sanitary Standard is applied to the farm bulk tank.

(b) Surface Cooler. In a surface cooler, also a continuous-type cooler, milk flows by gravity over tubes which contain coolant. Cold water is usually used as the coolant in the top section, and a refrigerant, such as ammonia, is used in the bottom section. The cooler should be covered to keep contaminants from entering it.

(7) (c) Plate Cooler. The plate cooler is another continuous-type cooler; it is similar in construction to the cooling section of the HTST pasteurizer. The milk on one side of the plate is cooled by the refrigerant on the opposite side. Another type of continuous cooler is the tubular cooler; in this cooler, milk flows through a tube, with refrigerant in an adjoining tube or flowing over the tubes.

(7) Milk Storage Tanks. AFter the milk has been cooled, it is placed in insulated storage tanks to await further processing or transportation to a pasteurization plant. Milk-contact surfaces, constructed of stainless steel, may be of various sizes, shapes, and designs. They are provided with agitators to keep the milk from creaming. Milk storage tanks may be equipped to refrigerate the milk in the tank.

(8) Milk Heaters. Milk may be heated by either batch-type or continuous-type heating.

(a) Batch-Type. Batch heaters are identical to batch coolers; however, hot water is used instead of cold water. In this method, various types of vats or tanks may be used. They may be jacketed, with a space between the outside wall and the invisible lining. Hot water or hot water mixed with steam may be introduced into this space to warm the product. Vats or tanks may also be constructed with tubes or coils of tubes in direct contact with the product. Hot water and steam may be circulated into these tubes to heat the product.

(b) Continuous-Type. This is the use of a plate heater, similar to the plate cooler; however, hot water mixed with steam is used instead of coolant. In some processes, milk may be heated by direct steam injection. Heat is applied in hot wells by direct steam injection in the manufacture of concentrated milk. Pasteurizers, such as the vacreator, also operate on this principle.

c. Standardization. Standardization is the raising or lowering of the percent of fat in milk or cream to a desired standard. In order to minimize contamination of the finished product, standardization takes place before pasteurization. Raw milk may be standardized to the required milkfat percentage by the following methods:

(1) Skim milk may be added to the whole raw milk until the desired percentage is achieved;

(2) Raw milk may be passed through a separator to produce standardized milk;

(3) Cream may be added to milk from which more than the required percentage of milkfat has been removed.

d. Separation of Milk in a Centrifugal Cream Separator. The purpose of the cream separator is to separate the cream (containing most of the milkfat) from the whole milk, leaving skim milk. The cream separator is essentially the same as the centrifugal clarifier. It consists of an inclosed bowl with numerous cone-shaped disks. There is one inlet for whole milk, an outlet for cream, and another outlet for milk. Milk enters some separators through the top, others at the bottom. The disks rotate at a high speed, and the heavier milk (such as the heavier sediment particles in the clarifier) moves to the outside of the bowl. The lighter cream, containing most of the butter, moves to the inside of the bowl. As the milk and cream move upward inside the bowl, the two products are removed at separate outlets. Some types of separators are air-tight and pressure-fed by a displacement pump; others are fed by gravity flow.

e. Pasteurization. Pasteurization is the process of heating every particle of milk to a predetermined temperature for a predetermined period. This process destroys disease-producing bacteria without materially altering the flavor or consistency of milk. The purpose of pasteurization is to kill such disease-producing organisms as tuberculosis, typhoid, Q fever, and brucellosis. Pasteurization inhibits the enzyme, lipase, which causes rancidity in milk. The types of pasteurization processes are:

TYPE	TEMPERATURE	TIME
Vat or batch	145° F.	30 minutes
High temperature-short-time	161° F.	15 seconds
Ultra high temperature	194° to approximately 260° F.	Instantaneous 1 1/2 to 3 seconds

(1) Vat or Batch Pasteurizer. This type of pasteurizer (see figure 9-1) is made up of:

(a) A jacketed well which contains the hot water and steam for heating purposes.

(b) An air-space heater which pasteurizes the foam on top of the milk. Dry steam is introduced into the space between the vat cover and the milk.

(c) Two indicating thermometers - a long steam thermometer and an air-space thermometer. The latter thermometer gives a direct reading of the temperature of the air and foam above the milk.

(d) A time and temperature recording thermometer. An indicating thermometer. An indicating thermometer gives a direct reading of the temperature of the milk that is being pasteurized. A recording thermometer provides a permanent record of the temperature of the milk while it is being pasteurized, and the length of time that the milk is held at this temperature. If the milk is preheated to pasteurization temperature before the vat is filled, or if the product is not cooled until after the vat is emptied, the filling time and the emptying time must be added to the pasteurization cycle.

(e) Drip deflector aprons, designed to keep condensates and other contamination from entering the vat cover.

(f) Agitator and agitator shaft and motor, designed to distribute the heat evenly and to keep milk from burning on the sides of the vat. Milk must be properly agitated during pasteurization. The agitator forces hot milk into the outlet channel, thus preventing a "cold spot."

(g) A leak-protector valve, designed to keep milk from dripping into the forward flow line when the valve is in a closed position. Milk trapped in the channel of the valve will drip onto the floor and will not contaminate the pasteurized milk. If the outlet pipe is not disconnected during filling, heating and holding, a leak-protector valve is needed on the outlet valve. If the inlet line is kept in position during pasteurization, this valve must also be of the leak-protector type.

(2) Other Types of Vat or Batch Pasteurizers:

(a) Coil-Type Pasteurizer. This type of pasteurizer is often used in pasteurizing cream for buttermaking. Since the coil pasteurizer does not agitate the cream excessively, no churning takes place.

(b) Spray-Type Pasteurizer. This type of pasteurizer heats the milk by directing a spray of steam and hot water against the liner of the vat. It usually has a paddle-type agitator.

(3) HTST Pasteurization. Milk flows through this type of pasteurizer (see figure 9-2) in the following order:

(a) Cold raw milk is received in the constant level tank with the help of a float valve. This tank keeps the milk at a constant level to supply the processing system.

(b) The milk flows to the regenerator section of the pasteurizer where it is heated to about 136° F. The regenerator is also called the heat exchanger because, by exchange of heat, cold raw milk cools the hot pasteurized milk, and hot pasteurized milk warms the cold raw milk. In this section, cold raw milk is on one side of the plate while hot pasteurized milk is on the other side.

(c) From the regenerator, the raw milk flows to a timing-displacement-type pump which regulates the flow of milk through the pasteurizer. This pump is also regulated to control pasteurization time in the holding tube. The timing pump then pulls the raw milk from the regenerator section of the pasteurizer (negative pressure) and forces pasteurized milk through the regenerator section (positive pressure). If a leak develops in a plate or gasket while the pump is running, pasteurized milk will leak into the raw milk, but no raw milk will leak into the pasteurized milk.

(d) Raw milk flows from the timing pump into the heating section of the plate pasteurizer and is heated to 161° F. If desired, the HTST pasteurizer may be operated at higher pasteurization temperatures and longer holding times.

(e) The milk then flows through a holding tube where it is held at 161° F. for at least 15 seconds. Tubular holders should slope not less than one-fourth of an inch per foot (continuously upward) from the inlet to the milk flow.

(f) At the end of the holding tube, milk passes the bulbs of the indicating and recording thermometers. The indicating thermometer gives a direct reading of the temperature of the milk and serves as a check on the accuracy of the recording thermometer. The recording thermometer is regulated to control the flow diversion valve.

(g) From the holding tube, milk passes a flow diversion valve. If the temperature of the milk is less than 161° F., the milk is diverted back to the balance tank for passage through the pasteurizer again.

(h) When temperature of the milk is 161° F., or higher, it flows forward into the regenerator section of the pasteurizer. There it warms the incoming raw milk and becomes cooled by the cold raw milk. Usually, it is cooled to about 64° F.

(i) It then flows into the cooling section of the pasteurizer where it is cooled to 40° F., or lower, with brine or some other refrigerant.

(4) Ultra-High-Temperature Pasteurization. There are several types of ultra-high-temperature pasteurizers.

(a) Annular Film. The milk enters the annular channel of the heater and passes through as a 1/4-inch film at a velocity that ranges from a minimum of 5 feet per second. The milk is propelled under a pressure of about 2,500 pounds per square inch. The temperature of the product is raised from 40° to 165° F. in about 1 1/2 to 4 seconds. The pasteurization temperature ranges from 194° to 260° F., depending upon the product which is being pasteurized. Fresh milk is usually pasteurized at 210° F.; chocolate milk may be pasteurized at 250° F.

(b) Vacreator. The vacreator consists of the pasteurizing, intermediate, and final chambers; it uses direct steam injection to heat the milk. The infeed pump pumps milk into the unit. The milk is pasteurized in the pasteurizing chamber by direct steam injection (194° to 200° F.) to remove part of the added steam. In the final chamber, the milk is treated under greater vacuum (110° F.) to remove the balance of the steam and is then removed as a finished product by the discharge pump. Any volatile off-odors or off-flavors are removed with the elimination of the steam and condensate by the vacuum process.

f. Flavor Control Mechanism and the Vacuum System. A flavor control mechanism, such as a vacuum deodorizer, may be installed in a pasteurization system to reduce undesirable flavors and odors by removing the volatile agents. This mechanism is most popular in areas where undesirable odors from noxious weeds, such as onion or garlic, are a problem. The vacuum unit may be installed at various locations in HTST units - for example, at a point after the milk has gone through the flow diversion valve and before it has entered the regenerator section.

g. Clarification. Milk may be clarified in the receiving area, during the pasteurization process, or in both the receiving area and during the pasteurization process.

h. Homogenization. Homogenized milk is whole milk in which the globules are reduced in size and are so evenly dispersed throughout the fluid that no visible cream separating occurs after 48 hours of quiescent storage. The fat percentage in the top 100 cc should not vary more than 10 percent from the fat percentage in the remaining part of a 1-quart bottle. Milk is homogenized mose efficiently when it is warm. The purpose of homogenization is to reduce curd tension to make milk easier to digest. Milk in the HTST pasteurizer is usually homogenized after it leaves the regenerator and just before it enters the heating section. The homogenizer operates by using high pressure to force milk through a minute orifice.

i. Cooling. Immediately after pasteurization, the milk is cooled to 45° F., or lower.

j. Bulk Storage After Pasteurization. After pasteurized milk has been cooled, it is usually held in an insulated storage tank until the tank is filled.

k. Bottling Milk in Glass Containers. Used milk bottles are returned to the plant and placed in storage before they are used again. They are washed in a soaker-type washer or a jet-type washer. As most milk for military consumption is received in paper cartons, we will not discuss bottled milk further.

l. Packaging Milk in Paper Cartons. There are two general types of cartons.

(1) Broken Down or Roll Form Cartons. These cartons are formed, glued, and coated just before they are filled. Examples of this type of carton are:

(a) Pure-Pak. This carton is made by several companies, but it is prepared and filled in machines patented by the Excello Corporation.

(b) Seal King. The coating of this carton is plastic. The machine is patented by the Seal-right Company, Inc.

(c) Tetra-Pak. This is a Swedish-made carton which appears triangular when filled.

(2) Factory Prefabricated Cartons. Cartons may be prefaribricated at the factory, and only filled and sealed at the dairy plant. Examples of this type of carton are:

(a) Canco. A carton made by American Can Company and filled by a machine patented by this company.

(b) Perga. This carton is German-made.

(c) Conical-Shaped Carton. This carton is fitted for glass-bottle fillers.

m. Packaging Milk in Bulk Containers. MIL-STD-175, Minimum Sanitary Standards for the Equipment and Methods for the Handling of Milk and Milk Products in Bulk Milk Dispensing Operations, prescribes Department of Defense requirements for bulk milk dispensing cans and dispensers.

n. Storage of Milk Before Shipment. Milk in containers may be held in a cold storage room which has a temperature of from 35° to 40° F. before it is loaded, or it may be loaded directly into delivery vehicles. Storage areas should be clean, neatly arranged, free from undesirable odors and in good repair. The milk should not exceed 45° F. during storage.

o. Delivery of Milk. The temperature of milk being delivered under military contracts should never exceed 50° F. Delivery should be made in a refrigerated vehicle or compartment.

SECTION D

CLEANING AND SANITIZING DAIRY EQUIPMENT

We will devote this entire section to the methods and procedures involved in the proper cleaning and sanitizing of dairy equipment because of the importance of these procedures.

1. Steps in Cleaning and Sanitizing:

a. Rinsing Equipment After Use. Immediately after equipment has been emptied, it is flushed with fresh lukewarm water (its temperature should be about 100° F.) Cold water may be used, but it is not as effective as lukewarm water in removing milkfat. Hot water must never be used because it precipitates the proteins which enhance the buildup of milkstone. The visible milk solids can be removed with a brush.

b. Washing with Cleaning Compounds. Cleaning solutions are added to water, in accordance with the manufacturer's recommendations. They should be capable of removing soil or milk solids quickly from the equipment surfaces without corroding metal surfaces.

c. The Cleaning Process. A cleaning agent acts in the following:

(1) By Wetting and Penetrating. This action breaks the bond between the soil and the surface to which it adheres.

(2) By Emulsifying. This is the breaking of oils and fats into small particles, causing them to be distributed evenly throughout the cleaning solution.

(3) By Saponification. In this process, soaps are made from the fatty acids of oils and fats.

(4) By Suspension. In this action, insoluble particles are held in solution.

(5) By Solution. Some food constituents, such as sugars, go into solution in the cleaning solution.

(6) By Sequestering and Chelating. In this action, water is softened by tying up metallic ions, thereby preventing precipitation.

d. Chemicals Used in Cleaning Compounds. Chemicals used in the cleaning compounds may be classified in four groups:

(1) Alkalies. Alkalies soften hard water by precipitation of the hardness salts. If these precipitates are not dispersed in free-rinsing form, they tend to deposit on equipment as milkstone.

(2) Acids. Acids remove milkstone. Most acid cleaners are combined with wetting agents to provide the greatest possible penetration of soil. Weak acids, such as phosphoric, tartaric, and citric acids, have been found to be the most satisfactory.

(3) Polyphosphates and Chelating Agents. These are used because of their ability to keep mineral salts which are present in hard water from precipitating.

(4) Wetting Agents. Wetting agents lower the surface tension of water, and increase its ability to penetrate and contact all surfaces.

e. Scrubbing. Scrubbing is necessary for a cleaning compound to be effective.

(1) In handcleaning operations, the scrubbing action is done with brushes and sponges.

(2) In cleaning-in-place operations, the scrubbing is applied by the velocity of the cleaning solution. The USPHS has determined that the volocity of solution should be at least 5 feet per second for at least 15 minutes.

(3) It is not desirable to use gritty powders, metal sponges, and wire brushes because insoluble particles and fragments left in the equipment may damage surfaces. Stiff-bristled brushes can generally be used with satisfactory results.

f. Warm-Water-Rinse. The equipment is rinsed with warm water, which is usually about 145° F., or higher to remove all cleaning compounds.

g. Sanitizing After Cleaning. After equipment has been thoroughly cleaned, it is sanitized. Dairy equipment can be sanitized by steam, hot water, or chemicals. Plants sanitize equipment with chemicals or heat just before it is used.

(1) Steam. When steam is used, all surfaces of the equipment are steamed for at least 5 minutes.

(2) Hot Water. When hot water is used, it is pumped through the equipment. The temperature of the water at both the inlet and outlet ends of the assembly should not be less than 170° F. for at least 5 minutes.

(3) Chemical Sanitizing. Usually only three chemical agents are used in sanitizing dairy plants. They are various forms of chlorine; iodine compounds; and quaternary ammonium compounds. (Quaternary ammonium compounds are generally used only on dairy farms.) These agents may be applied to equipment surfaces by pumping, brushing, spraying, and fogging. A thin, continuous film over clean surfaces will give satisfactory results.

2. Methods of Cleaning and Sanitizing Dairy Equipment:

a. Handcleaning. In this method, individual pieces of equipment are cleaned manually with brushes, washing tanks, and other cleaning equipment.

b., Cleaning-In-Place (CIP). This method, also known as circulation cleaning, is becoming increasingly popular in the dairy industry. It involves flushing, cleaning, and rinsing the surfaces of dairy equipment and circulating sanitizing solutions throughout the equipment. A recording thermometer is installed at the end of the return line in order to furnish a dependable record of the length of time that the solutions were used and the temperatures of the solutions.

SECTION E

PROCESSING OF OTHER FRESH DAIRY PRODUCTS

1. Kinds of Products. Fresh whole milk is produced in far greater volume than miscellaneous fresh dairy products. Because of this disparity in production, the inspection of these miscellaneous products is often neglected. As a rule, these products are not as well-regulated as fresh whole milk, and they are often responsible for causing problems in inspection. The miscellaneous fresh dairy products are:

Cream and half and half
Buttermilk, cultured
Chocolate milk and drink
Skim milk
Cottage cheese

a. Cream and Half and Half. The types of cream usually procured for the military services are light cream, containing at least 18 percent butterfat; whipping cream, containing at least 30 percent butterfat; and half and half, containing at least 11.5 percent butterfat. Before cream is distributed, it is subjected to these processes:

(1) Separation. Whole milk is usually separated in a centrifugal separator. The percent of butterfat in the cream is controlled within moderate limits by adjusting the cream screw on the separator.

(2) Cooling and Storage. If warm separation has occurred, cream from the separator is cooled and put in a storage tank until it is ready to be standardized and pasteurized. The storage tank may be used for pasteurization.

(3) Standardization. Since most separators cannot accurately control butterfat percentage during separation, cream is standardized to the desired percent butterfat by adding whole or skim milk.

(4) Pasteurization. Cream (except whipping cream) may be pasteurized by the same procedure that is used to pasteurize milk. Because of its viscosity, whipping cream is not usually pasteurized by the HTST method or other continuous methods. Cream must be heated to higher temperatures than those which are normally required for pasteurization in order to inactivate the enzyme, lipase, and to remove the protective influence of the cream on bacteria at lower temperatures. If lipase is not inactivated, it may cause rancidity. During the pasteurization process, some agitation is required to prevent oiling off and to remove heat properly. However, after the product has been pasteurized and is being cooled, excessive agitation must be avoided to prevent churning.

(5) Cooling. Immediately after cream has been pasteurized, it is cooled to 40° F., or lower. Vat-type coolers are less efficient than continuous coolers. Many dairymen prefer surface cooling to vat cooling because surface cooling removes undeisrable flavors or odors by aeration.

(6) Homogenization. Light cream or cream with a butterfat content below 20 percent is usually homogenized. Whipping cream should not be homogenized because homogenization could make it impossible to whip.

(7) Aging. In order to improve the whipping ability and stability of whipping cream, it is usually aged at a low temperature for about 24 hours before it is distributed.

(8) Filling, Storage, and Distribution. These procedures are the same as those used in handling fresh whole milk.

b. Buttermilk. This product includes churned or true buttermilk, cultured buttermilk, and certain other cultured fluid products.

(1) Churned or True Buttermilk. Churned or true buttermilk is the fluid that remains after cream is churned into butter. Its compoiition is approximately the same as that of milk. Much cream used in buttermaking is high in acidity and must be neutralized with alkalies before it is churned. Such cream produces buttermilk which is often unpalatable.

(2) Cultured Buttermilk. Cultured buttermilk is prepared by souring skim milk. This souring is done with a culture of bacteria to produce the proper acid content and a desirable flavor and aroma. Cultured buttermilk is more uniform than churned buttermilk. It occasionally contains a few added chips of butter to improve its appearance. Cultured buttermilk is manufactured in two stages:

(a) Preparation of Starter. The starter is made from a mother culture. The original culture is usually bought from a dairy supply laboratory, and it generally consists of two types of bacteria - lactic acid bacteria and aroma bacteria. Lactic Acid bacteria, usually Strep. lactis or cremoris, increase the acidity of the buttermilk; aroma bacteria, usually Leuconostoc citrovorum or dextranicum, improve its aroma and flavor. The mother culture is usually maintained in the laboratory in a flask or other container. It must be carefully protected to keep it from becoming contaminated, and it must be kept cold so excessive bacterial growth does not occur.

(b) Preparation of Buttermilk:

1. The necessary amount of skim milk is placed in a buttermilk tank, usually a vat pasteurizer. It is heated to a temperature which is much higher than that needed for pasteurization. This is done to destroy as many organisms as possible, and to keep undesirable organisms from growing in competition with the desirable organisms (added culture).

2. The product is then cooled to the setting or incubation temperature of about 70° F.

3. The starter, which has already been prepared, is then added to the pasteurized skim milk. The amount added should be about 1 percent of the amount of skim milk in the tank. The starter is stirred into the skim milk to distribute the bacteria evenly.

4. The product is allowed to set until 0.75 to 0.84 percent acidity and firm coagulation of the solids have developed. This usually takes about 14 to 16 hours.

5. The buttermilk is finished by slowly stirring the curd until a smooth, uniform creamy product is created. Undue agitation in the tank should be avoided, since it will break down the body and produce a thin body buttermilk.

6. If desired, pasteurized cream or churned cream may be added to the buttermilk to increase its butterfat content and improve its appearance.

7. The finished buttermilk is cooled as rapidly as possible to 50° F. or below.

8. The finished product is bottled into containers in the same way that milk is bottled.

e. Chocolate milk and Chocolate Drink. The usual ingredients in chocolate milk or chocolate drink are:

Cocoa (about 1 to 1.5 percent).
Sugar (about 5 to 7.0 percent).
Stabilizer (about 0.2 percent).
Butterfat (as desired).
Skim milk.
Whole milk.
Dried milk (the remainder).

Typical steps in the preparation of chocolate milk or drink are given below; these steps may vary in some plants.

(1) Milk is placed in a vat pasteurizer or mixing tank and is heated to a temperature of about 150° F. If whole milk or milk containing butterfat is used, it is homogenized first.

(2) The ingredients (cocoa, sugar, and a stabilizer) are mixed together and added to the hot milk. The mixture is stirred thoroughly to make it homogenous.

(3) The mixture is held at 150° F. for 30 minutes, until pasteurization is complete; pasteurization may also be by HTST or ultrahigh temperature. In most operations homogenization takes place after pasteurization, while the product is still warm.

(4) The product is then cooled to 40° F., or lower.

(5) The product may then be bottled in the same way fresh milk is bottled.

d. Skim Milk. Skim milk is obtained by removing butterfat. After whole milk is passed through a separator, the resulting skim milk may be cooled and placed in a holding tank or it may pass directly from the separator to the pasteurizer.

SECTION F

QUALITY CONTROLS AND INSPECTION OF FRESH DAIRY PRODUCTS, INCLUDING BULK MILK

To establish and maintain quality controls, an inspection system which begins on the farm and continues through the processing plant is necessary. The standards are specified in contracts which involve the military services. As an inspector, you must know what a contract calls for in order to determine the inspections that are necessary.

1. Dairy Contracts. The purchasing and contracting officer of the local military establishment prepares and awards military contracts for fresh dairy products. Some contracts may occasionally be let by the Defense Personnel Support Center (DPSC). The primary contractual document specifies special requirements. The primary contract usually stipulates:

a. Size of the container.

b. Type of container.

c. Grade of the product to be procured.

d. Quantity to be delivered.

e. Time of delivery.

f. Other specific requirements.

The specification provides detailed information about:

g. Method of preparation.

h. Requirements of the grade.

i. Proper packaging.

j. Other items of importance.

The specification may cite still other documents, such as the military standards and DPSC clauses. All such documents become a part of the contract which guides the inspector.

2. Inspection of Raw Milk. Veterinary personnel responsible for inspection must review plant and health inspection results and programs to insure that they are satisfactory. When these practices are in compliance with Air Force standards, they are accepted. This is done so military personnel will not duplicate other inspections which are adequate. In many oversea areas, military inspectors examine raw milk supplies. Some of the examinations and tests are:

a. Organoleptic (daily).

b. Temperature (daily in certain warm areas).

c. Sediment.

d. Direct microscopic.

e. Standard plate count.

f. Methylene blue or resazurin.

g. Antibiotic.

h. Coliform (not standard at present but many plants use it as an aid to indicate cleanliness).

i. Residues.

3. Inspection of Finished Products:

a. Performing Inspections. Products are usually inspected when they are delivered. Under special conditions and in oversea areas, products may be inspected at the plant of origin before they are shipped. The time a product is delivered at a military reservation is considered the time between the arrival of the vehicle delivering it and the time of its final unloading from this vehicle. Most military reservations maintain a central inspection point where finished products are inspected. This veterinarian, the cold storage inspection office, or another designated area. An inspector must be available to inspect products when they arrive at the designated inspection point.

4. Examination of Milk in Bulk Dispenser Containers. Our discussions of the inspection of milk and milk products in general have dealt with products in consumer-size containers, such as half-pints, pints, quarts, and half-gallons. We will now discuss the inspection of milk and milk products in bulk dispenser containers. The specifications for the procurement of milk in bulk dispenser cans are set forth in the Federal Specifications for Milk, Whole, Fresh. The principal document governing the procurement of milk in bulk dispenser cans is MIL-STD-175 and AFR 163-7. A supplemental publication is 3-A Sanitary Standards for Manually Operated Bulk Milk and Milk Products Dispensers, Multi-Service Milk Containers, and Dispensing Mechanisms.

a. Design Requirements of Dispensing Cabinets:

(1) NSF or USPHS approved.

(2) Dial thermometer on front of machine.

(a) Danger Zone red (44° F.+).

(b) Safety Zone (32° - 44° F.).

(c) Freeze Zone (Below 32° F.).

(3) Must be capable of cooling inside air to safe zone within 30 minutes after refilling dispenser.

b. Procedures for Examination:

(1) As required by MIL-STD-175, the date (day and month) and the time (A.M. or P.M.) that pasteurization took place is indicated on a tag which is firmly attached to the can, or it is stenciled on the shipping container. Each shipment is checked to determine that the product is delivered within 48 hours* after it is pasteurized. The accuracy of the information on the tag will be verified periodically. Liaison with the veterinary inspector who is responsible for sanitary inspection may be established for this purpose.

(2) Milk may be supplied in either multiple or single-service dispensing containers.

(3) Multiple-service dispensing containers will be inspected at the time of delivery in compliance with MIL-STD-175 to determine that:

(a) Only homogenized milk and homogenized milk products are delivered in dispenser cans.

(b) Only single-service dispenser tubes are used.

(c) A single-service parchment or parchmentized paper covers the product and the lid covers the paper.

(d) The can lid is sealed into place with lead wire seals at two opposite places.

(e) Cans are properly labeled.

(4) The empty cans will be inspected as often as necessary before they are returned to milk plants in order to determine if:

(a) Seals are broken and cans are rinsed to remove residual milk film.

(b) Dispenser tubes are removed and are not returned to the milk plant.

(c) Dispenser cans have not been used for any other purpose before they are returned to the milk plant.

(d) Dispenser cans with rust spots on their inner surfaces, creases, or open seams are not being used.

(e) Dispenser cans meet dimensions, construction, fabrication, and material requirements.

(5) Each time the product is sampled for laboratory testing, determine the delivery temperature (under 50° F.) and also check the temperature on each delivery. The procedure for determining delivery temperature accurately is as follows:

(a) After the milk in a representative sample can has been thoroughly mixed the dispenser tube will be clamped and aseptically cut.

(b) Eight to sixteen ounces of milk are allowed to flow into a glass sample container to adjust the temperature of the container. This milk is discarded and the container is immediately refilled.

* Federal Specification C-M-1678 allows delivery within 72 hours after pasteurization; MIL-STD-175 will probably be revised in the near future to coincide with the specification.

(6) A single-service dispensing container consists of a plastic liner in a fiberboard box. These containers will be inspected at the time of delivery, in accordance with MIL-STD-175, to determine that:

(a) Necessary information is stenciled on the fiberboard container.

(b) Containers meet the requirements for dimension, construction, fabrication, and material requirements.

(7) Single-service dispensing containers are discarded promptly after they have been used.

c. Determining Volume. It is impractical and undesirable to open the cans in order to determine the volume of milk that they contain, since this requires breaking seals and leaves cans vulnerable to possible contamination. The volume in a can is determined by computing the net weight of the milk it contains on the basis of 8.6 pounds per gallon of whole milk. This procedure cannot be followed with cream or other milk products that may be delivered in bulk dispenser cans because their weight per unit volume varies with fat content. The following procedure for determining the volume of milk in dispenser cans is recommended:

(1) Before the beginning of a milk contract, the contractor specifies the average tare weight of cans, lids, tubes, and seals, as a complete unit. The size, design and type of material varies with different manufacturers. A contractor who uses cans of different weights in a single delivery furnishes the inspector with the average tare weight for each group; identifying features of each group; and certification of the different group tares. The contractor certifies to this tare weight on the shipping document; the inspector is given a copy of this document.

(2) As an alternative - if the contract permits - the contractor may emboss, paint, or imprint a legible, durable tare weight on each can. He provides the inspector with a list of items making up the total weight, as stated on the can.

(3) To insure that the contractor's tare weight is correct, the inspector will verify the information frequently. The following procedure for verifying the tare weights of dispenser cans is recommended:

(a) A central inspection point will be equipped with an accurate scale for verifying the contractor's tare weights. Before a delivery vehicle returns empty cans to the milk plant, it stops at this point. Empty and dry sample cans are drawn at random from this vehicle. Recommended minimum sample sizes are listed in AFR 163-7.

(b) The scales are tested with test weights to insure that they are accurate. The weights of the cans are increased by the weight of the appropriate number of attachments. For example, if the sample size is three cans, the weight of three dispenser tubes, six wires and seals, three dispenser tube covers, and three information tags are added. The weight of the cans plus the weight of the attachments are determined to the nearest 1/4 pound. The resulting weight is divided by the number of sample cans, giving an average weight per can. If the contractor's average tare weight per can does not vary more than .25 pound per can from the average tare weight per can found by the inspector, the contractor's tare weight will be considered reliable. If the contractor's average tare weight per can does vary more than .25 pound per can from the average tare weight per can found by the inspector, the contractor's tare weight will not be considered reliable, and the inspector will recommend corrective action.

(4) The inspector determines the net weight of milk in accordance with AFM 74-15, Appendix A.

(a) On a day selected at random, sample cans are drawn from the delivery vehicle and examined for volume.

(b) To insure accuracy, scales are tested with test weights.

(c) The gross weight of the sample cans are recorded to the nearest 1/4 pound.

(d) The tare weight of the sample cans is calculated and subtracted from the gross weight.

(e) To obtain the average net weight per can, the resulting net weight of the sample cans is divided by the number of sample cans.

(5) The average net weight per can must not be less than 8.6 pounds per gallon of content in each can. For example, for whole milk, it should be not less than 43 pounds for 5-gallon cans, and 25.8 pounds for 3-gallon cans.

3. Sampling Milk from Bulk Dispenser Cans:

a. Place and Time of Sampling. The inspector may designate where milk is to be sampled. This area must be protected from contamination.

b. Number of Sample Cans. One sample can will usually be representative of the shipment; however, the veterinary inspector may request more than one can if he considers this necessary. The specimen collected for laboratory testing will be collected from separate cans. When more than one can is sampled, a composite sample is made for the laboratory. Sample cans will be selected at random in order to be representative of a shipment.

c. Agitation of Milk in Sample Can. Immediately before the tube is removed from its secured position, the contents of the can are thoroughly agitated. This can be done by inverting the can five or six times, or by rocking it vigorously on a 90-degree arc.

d. Procedure for Removing Specimen from Sample Can. Throughout the procedure of collecting the specimen, care must be taken to insure that neither the container nor the specimen is contaminated.

(1) Method No. 1. As soon as agitation has been completed, these steps will be taken:

(a) Put the sample can on a table in a clean area where it is protected from dust and other contamination.

(b) Release the free end of the dispenser tube from its position; remove any protective covering.

(c) Clean the last 3 inches of the free end of the tube of the milk can with a sterile swab saturated with 70 percent isopropyl.

(d) Place a pinchcock clamp or hemostatic forceps on the tube just above the sterilized area.

(e) Flame, or treat germicidally, the knife, razor blade, or any other device intended for cutting the tube.

(f) Cut the tube about 1 inch from the free end in the sterilized area in a way that will keep the tube from becoming contaminated. (You may hold the free end of the tube in your fingers or with another pair of hemostatic forceps while you cut it).

(g) Before collecting the specimen for laboratory testing, remove at least 1/2 pint of milk through the dispenser tube.

(h) Determine the delivery temperature.

(i) Prepare a sterile specimen bottle (10-12 ounce capacity) for collecting the laboratory specimen by removing and handling the cover so that the internal surface of the cover or container does not become contaminated.

(j) Sterilize the mouth of the bottle by flaming.

(k) Fill the sample bottle to two-thirds or to three-fourths of capacity by releasing the clamp or forceps and letting milk flow into it through the dispenser tube.

(l) Carefully replace the lid on the bottle.

(m) Fold the dispenser tube about 2 inches from the cut end and wrap a piece of adhesive tape or other suitable material around the folded tube in a way that will keep it from leaking until it is placed in the dispenser cabinet.

(n) Fold the tube into a secured position to protect it from contamination until it is ready for use in the dispenser cabinet.

(o) Tag, or otherwise identify, the can so that food service personnel will know that it was sampled.

(p) Properly identify the specimen and put it in a precooked sample container for transmittal to the testing laboratory as expeditiously as possible.

(2) Method No. 2:

(a) Place the can, randomly selected from the vendor's vehicle, in a dispenser cabinet.

(b) Remove the free end of the tube from its secured position; also remove any protective covering.

(c) Thread the tube through the dispenser valve in the usual manner for dispensing.

(d) Treat the tube and the cutting device germicidally, as prescribed in method No. 1.

(e) Cut the tube in the sterilized area in a way that does not contaminate the tube. (The tip of the free end of the tube may be supported with the fingers or with a pair of forceps while it is being cut).

(f) Before collecting the specimen, remove at least 1/2 pint of milk through the dispenser tube to insure that the specimen is taken from the mixed contents of the can.

(g) Use a sterile sample bottle of at least 250 ml. capacity to collect the specimen for laboratory testing.

(h) Remove the cover and handle so that the internal surface of the lid or container does not become contaminated.

(i) Sterilize the mouth of the bottle by flaming.

(j) Fill the sample bottle from two-thirds to three-fourths of capacity and replace the lid.

(k) Properly identify the specimen and put it in a precooled sample container for transmittal to the testing laboratory by the most expeditious means.

SECTION G

MANUFACTURE AND INSPECTION OF ICE CREAM AND SHERBETS

1. Introduction:

a. Frozen Desserts. Frozen desserts are classified according to the kind and amount of ingredients used in them. The classifications are as follows:

(1) Ice Cream. Ice cream is a whipped and frozen food made from a mixture of dairy products and other ingredients. It is prepared by mixing milk products, sugar, egg products, flavorings, and other ingredients, then incorporating air, and freezing the mixture. The composition of ice cream probably varies more than the composition of any other dairy product since countless possible combinations of ingredients can be used in it. The minimum fat content of ice cream is 8 to 15 percent, depending on local or State requirements.

(2) Sherbets. Sherbets resemble ice cream, but are not nearly as rich. They contain less fat and serum solids but more sugar.

b. Ingredients Used on Ice Cream and Sherbets. Ingredients which may be used to make ice cream and sherbets are:

(1) Milk Products. Some of the milk products which may be used to manufacture ice cream are:

Milk
Cream
Skim milk
Plain condensed milk
Plain condensed sweet buttermilk
Plain condensed skim milk
Sweetened condensed milk
Sweetened condensed skim milk
Superheated condensed milk
Evaporated milk
Skim milk powder
Sweet buttermilk powder
Sweet unsalted butter
Butter oil
Casein
Milk albumin
Malted milk
De-lactosed milk.

(2) Sweetening Ingredients. Sweetening ingredients must be of edible grade. One of the following ingredients may be used:

Sucrose dextrose
Sugar syrup
Invert sugar syrup

Corn syrup
Dried corn syrup.

(3) Flavoring Ingredients. Flavoring ingredients must be of edible grade. They may be a source of high bacteria counts in the finished product. Flavoring is usually added after the mix is pasteurized; therefore, the inspector may find it expedient to sample the pasteurized ice cream mix before the flavoring is added to it. Certain flavoring ingredients produce a positive phosphatase test. Flavoring ingredients may be added to the basic mix in liquid form, in bulk form, or in both forms.

(4) Egg Products. Egg products used to make ice cream must be of edible quality, and must be free from unnatural or objectionable flavors or odors. If they are not handled properly, they may be a source of high bacteria counts in finished products. Egg products improve the whipping potential of mixes in batch freezers, but are not needed in mixes which are frozen in continuous freezers.

(5) Coloring Ingredients. Coloring materials are used in frozen desserts to improve their acceptability. They must be certified by the Food and Drug Administration.

(6) Stabilizers. Stabilizers are substances (hydrophilic colloids) which have a characteristic that enables them to absorb and retain large volumes of water. This characteristic allows the product to be frozen with the formation of small ice crystals and keeps coarse texture (growth of ice crystals) from developing during storage. Gelatin and sodium alginate are two of the most common stabilizers. Other materials which may be used include:

Gum
India gum
Karaya gum
Locust bean gum
Irish moss
Monoglycerides and diglycerides
Agar agar
Pectin
Psyllium seed extract
Quince seed extract
Sodium carboxymethylcellulose

(7) Emulsifiers. Emulsifiers are substances used to help disperse fat throughout a mix, and to tie the fat emulsifier and water together. In the manufacture of ice cream, monoglycerides and diglycerides can serve as emulsifiers and stabilizers.

(8) Salt. Salt must be of edible grade. Its flavor should not be detectable in the product.

(9) Water. The moisture content of the ingredients and the moisture content which is desired in the finished product determine the amount of water which may be added to a mix during manufacture.

(10) Acids. Citric, maltic, or lactic acid may be used to enhance the flavor of sherbets; their use in ice cream is not permitted.

2. Manufacture of Ice Cream, Sherbets, and Novelties:

a. Steps in Ice Cream Manufacturing. The steps presented below are followed in manufacturing ice cream.

(1) Receipt and Storage of Ingredients. Ingredients may be solids, semisolids, or liquids. Ingredients should be adequately stored until they are needed; they must be protected from adulteration and contamination while they are in storage. The

elimination of vermin (rodents and insects) and proper warehousing will protect products which are packed in fiberboard barrels, drums, and bags.

(2) Combining and Mixing. Ingredients are assembled and mixed in a vat; a vat pasteurizer is often used. If solid ingredients are used, they are measured and added after heating of the liquid portion has started. Liquids may be added by remote control by using automatic measuring devices. Standardization to the proper butterfat and solids content can be accomplished at the time of mixing; this must be done before pasteurization. Frozen ingredients, such as frozen eggs, must be completely thawed before the mix can be pasteurized.

(3) Pasteurization. When the phosphatase test is used to determine the adequacy of pasteurization, the mix must be sampled after pasteurization but before the flavoring ingredients may produce false positive results. The mix, containing all ingredients except flavoring agents, must be pasteurized. This may be done by the vat method or the continuous method.

(a) Vat Pasteurization. The same equipment methods which are used to pasteurize other fresh dairy products are used. However, higher pasteurization temperatures are necessary because of the density of the mix. A much higher temperature is necessary in order to destroy the lipase enzyme which may cause rancidity in the finished product, and in order to improve the whipping quality of the product. (155° F. for 30 minutes.)

(b) Continuous Pasteurization. The method of continuous pasteurization must comply with the requirements of State health authorities. It must produce results which are equivalent to those obtained in the vat method with a heat process of at least 175° F., for not less than 25 seconds.

(4) Homogenization. This step is necessary to disperse the fat and solids, produce a smoother mix, make whipping easier, and prevent churning of the fat in the freezer. A mix is homogenized most efficiently after vat pasteurization, while the mix is hot.

(5) Cooling. After homogenization, the mix must be slowly cooled in the 80° to 50° F. range in order to obtain an increased viscosity. It may be cooled in a vat, or cooled continuously by means of a surface cooler or plate cooler. If no special equipment is used to remove volatile odors (such as a vacreator or vacuum deodorizers), a surface cooler which aerates the mix will achieve similar results.

(6) Storage. To increase its whipping qualities, the mix may be stored (or aged) after it has been cooled. Storing also decreases the time it takes to obtain the proper overrun when it is frozen in a batch freezer. (Overrun is the volume increase of a product over the original volume that is accomplished by the incorporation of a worthless substance, such as air). When ice cream is frozen in a continuous freezer, storage (or aging) has little effect on its properties.

(7) Flavoring. All liquid flavoring ingredients, except chocolate-flavored ingredients, are added just before freezing. Chocolate-flavored ingredients are added while the mix is being prepared. A single flavoring tank may be used to supply one or more freezers. If bulk fruits and nuts are used, they are added after partial freezing.

(8) Freezing. Freezing converts the liquid mix into a semisolid, frozen, crystalline form with the incorporation of air (overrun). Overrun is calculated as the ratio of mix to finished product and is expressed as a percentage factor; for example, if 1 quart of mix makes 2 quarts of ice cream, the overrun is 100 percent. Ice cream is frozen in either the batch-type freezer or the continuous-type freezer.

(a) Batch-Type Freezer. This type of freezer, mounted on a base and connected to a motor and a refrigeration unit, consists of a cylinder which contains a scraper and a beater. The cylinder supplies the power which turns the scraper and beater; the refrigeration unit supplies the coolant. The mix is transferred to the batch-type freezer through a large hopper or mix-supply tank which is on top of the freezer. The temperature of the mix at this time is about 40° F. When the freezer is started, this temperature rapidly drops to the freezing point. The frozen ice cream mix is scraped from the wall of the cylinder, and the beater working in the center of the scrapers (in the opposite direction) whips air into the mix. The refrigeration is turned off when the ice cream mix appears to have attained proper stiffness. Whipping, however, is continued, expanding the volume of ice cream by incorporating air until the desired overrun is obtained. The partially finished ice cream is then withdrawn from the freezer, with about one-third of its moisture frozen and in a semisolid state. It is then flavored, packaged, and hardened.

(b) Continuous-Type Freezers. Several types of continuous-type freezers are in use. This type of freezer is similar to the batch-type freezer except that the freezing process in it is continuous. The ice cream mix enters through the mix pump and flows into the freezing chamber where the air pump draws air through a filter. The air is then forced into the freezing chamber where it is incorporated in the mix. Ammonia coolant freezes the product. The ammonia coolant stored in the accumulator flows downward, surrounding the freezing chamber. As the mix gives up heat, this coolant converts from liquid to gas and the temperature of the chamber is reduced to the freezing point. The whip is mixed by the action of motor-driven scraper blades and beater. The ice cream then flows from the delivery outlet of the continuous freezer and is ready for packaging.

(9) Bulk Flavoring. In batch freezing, bulk fruits and nuts are added to the freezer a short time before the ice cream is removed. In continuous freezing, bulk fruits and nuts are added to the partially frozen ice cream mix through a fruit feeder. This feeder is designed to measure and mix the bulk flavorings into the partially frozen ice cream mix; otherwise, the fruit would be smashed and pulverized, if added with other flavorings and passed through the freezer.

(10) Packaging. The batch-type freezer and the continuous-type freezer permit bulk packaging of ice cream directly from the freezer. However, special packaging machines may be used to package it in numerous styles of containers.

(11) Hardening and Storage. Ice cream may be hardened in a hardening tunnel or a room with temperatures of -20° F., or lower. (The hardening process is a continuation of freezing). Ice cream may be stored at -10° to -20° F. for relatively long periods. At this temperature, 90 percent or more of the water is in a crystalline state and is not available for microbial metabolism. Ice cream stored for a short time will show a slight decrease in its bacterial count. Ice cream stored at about 10° F. for long periods may lose its incorporated air and develop a plastic appearance and consistency.

b. Manufacture of Sherbets and Novelties:

(1) Sherbets. Sherbets, generally containing less milkfat than ice cream, are prepared by a method similar to the one used to prepare ice cream. The ingredients needed in sherbets are milk products, sweetening ingredients, and flavoring (as specified). The optional ingredients are stabilizers, emulsifiers, acids, coloring, and salt.

(2) Novelties and Specialties. Special techniques and equipment are needed to produce novelties and specilaties. Among the great variety of frozen novelties and specialties which can be produced are:

Ice cream cake
Ice cream pie
Log rolls
Creamsicles
Popsicles
Fudgesicles
Drumsticks
Chocolate-coated bars.

3. Sanitation in Ice Cream Production.

a. Sources of Contamination. When ice cream is improperly manufactured, stored, or handled, it can be a source of contamination or food poisoning to the consumer. The organisms of tuberculosis, typhoid fever, undulant fever, and other pathogens have survived in ice cream for many months. Occasional chemical poisonings have been reported. Dairy products and flavoring used in the manufacture of these products are the chief sources of contamination; flavoring materials - both liquid and bulk - are particularly important sources, since they are added after pasteurization. Improper storage of ingredients and packaging materials used to make these products may cause contamination. Cones, dry milk products, and other food products often attract rodents and insects. These vermin may not only contaminate the food ingredients but also cartons, wrappers, and paper which come into contact with the finished product. Dirty equipment, such as flavoring measuring cups, milk cans, vats, coolers, storage tanks, fillers, and molds can be sources of microbial contamination. Because of their construction, homogenizers and ice cream freezers are especially serious sources of contamination. Employees who practice poor personal hygiene and have poor working habits may be a source of contamination when they come in contact with the products. Dirty surroundings, such as dusty, poorly drained floors, and improperly filtered air for freezers, may be other sources of contamination. Faulty pasteurization or mixing of the pasteurized product with raw ingredients can cause high bacterial counts in ice cream.

b. Sanitary Inspection of Plants. Sanitary standards for ice cream plants are comparable to these standards in plants which process other dairy products. Besides the potential sources of contamination mentioned above, sanitary inspections should be made of receiving facilities, lighting, the construction and repair of buildings and equipment, water supply, waste disposal, ventilation, and toilet facilities.

c. Inspection of Ice Cream and Ice Cream Plants. Plants supplying ice cream to the armed forces must be inspected and approved by members of the military veterinary services.

d. Inspection of Finished Product. Finished product requirements are usually determined by inspection when the product reaches its destination. The vehicle carrying the product is inspected for sanitation and temperature. Samples are selected and organoleptic examinations and test weighing performed. If the truck makes more than one stop on a military reservation, samples should occasionally be selected at the last delivery point. Selected samples will be submitted to the laboratory for bacteriological and chemical tests.

e. Sampling Ice Cream for Laboratory Analysis:

(1) Sampling consumer packages of ice cream received in 1/2 gallon containers (or in containers which have less capacity) should be submitted to the laboratory unopened. Packages will be selected by random sampling. The samples must be protected from thawing and must be kept solidly frozen by means of dry ice until they reach the testing laboratory.

(2) Samples from bulk containers of ice cream received in containers larger than 1/2 gallon should be selected aseptically by placing at least 1/2 pint in a sterile sample container. Samples must be submitted to the laboratory in solid and frozen states.

(3) Samples of ice cream will be selected for laboratory testing as often as the contract prescribes. Enough samples should be taken to insure an adequate reading of the quality and bacterial content.

(4) Routine tests of butterfat, standard plate count, and coliform count are usually made at the laboratory for compliance with specifications.

SECTION H

MANUFACTURE AND INSPECTION OF PROCESSED MILKS

Concentrated dairy products, known in the industry as processed milks, are milk or milk byproducts from which some water has been removed. Dairy products are concentrated in order to reduce transportation and warehouse space, and to produce items which are easier to merchandise than fresh milk.

1. Kinds of Concentrated Dairy Products. The fluid concentrated dairy products include plain condensed milk (whole or skim), concentrated whole milk (for reconstitution), sweetened condensed milk (whole or skim), evaporated milk (whole or skim), condensed buttermilk, semisolid buttermilk, condensed whey, and ice cream mix paste.

a. Plain Condensed Milk. This, the simplest type of concentrated product, is whole or skim milk from which part of the water has been removed under vacuum. This product is usually concentrated in a ratio of 2.5:1 to 4:1, depending on the concentration of milk solids that the consumer wants. Plain condensed milk may be used to prepare candies, bakery products, and ice cream; it may be an intermediate component in the preparation of dried milk products. Procurement of this product in the armed forces is generally limited to amounts purchased for commissary resale. Because of the limited use of this product in the military services, we will not discuss processing procedures for this concentrated milk. For the production of plain condensed milk, raw milk is usually of manufacturing grade and has no rigid bacteriological standards other than those set by the company or local authorities. Platform grading by the company provides for the rejection of undesirable raw milk. Milk which reduces methylene blue in less than 2.5 hours (estimated plate or clump count more than 3,000,000 per ml.) is usually recommended for rejection.

b. Concentrated Whole Milk:

(1) Description. Concentrated whole milk is Grade A whole milk from which some water has been removed, with a minimum damage to the character of the product. As a result of this action, the product may be reconstituted and used for human consumption without further processing. The raw milk for concentrated whole milk is handled under more rigid sanitary standards than raw milk for other condensed milks. The product is usually condensed in a ratio of 3:1. The finished product may be refrigerated or frozen; it may be packed in bulk containers or single service containers.

(2) Manufacture. This product is usually processed in approximately the same equipment and by the same method as plain condensed milk.

(a) This product requires more careful handling insofar as temperatures and the prevention of contamination are concerned than other condensed milks.

(b) High heat in the hot well and evaporator is avoided so the character and flavor of the product will be preserved as much as possible.

(c) The product may be handled in one of two ways after it has been homogenized.

1. It may be immediately pasteurized at a high temperature (175° F., for 15 seconds) and bottled, or

2. It may be filled into bulk containers (stainless steel drums) and shipped under refrigeration.

(d) Volatile flavors, such as those attributed to different types of feed, are usually removed during the condensing process.

(3) Defects. Concentrated milk usually has the same defects that homogenized, pasteurized milk has, plus the following:

(a) Sandiness, which may result from excessive evaporation.

(b) Rancid, unclean, putrid, and cheesy conditions, which are encountered almost as often as sourness. These conditions may be caused by the inability of acid-producing organisms to grow well at the usual holding temperatures (below 50° F.) for this product.

(c) Concentrated milk is not a sterile product and does not inhibit the growth of microorganisms. To keep the quality of the product, it is of the utmost importance to refrigerate it and keep it uncontaminated.

c. Sweetened Condensed Milk:

(1) Description. Sweetened condensed milk is whole or skim milk to which sugar has been added and from which some water has been removed under a vacuum. It is used primarily for ice cream, pastries, and candies, and is usually condensed to a ratio of about 2 1/2:1. Sweetened condensed milk is thick and syrupy because of its high sugar content of about 44 percent.

(2) Manufacture. This product is usually made from manufacturing grade raw milk; the quality of this raw milk directly affects the quality of the final product. The raw milk is checked as follows: organoleptic (odor, flavor, and physical character); acidity; sediment; and microorganisms (methylene blue, resazurin, or direct microscopic). In the processing, the

(a) Milk is heated to 180° to 212° F., in a steam-jacketed kettle and by the injection of live steam;

(b) Sugar and hot water (190° F.) are made into a 65 percent syrup;

(c) The syrup is added to the hot milk.

(d) The mixture is condensed at 135° F. to the desired proportion.

(e) After the milk has evaporated, it is routed to tanks where the temperature is about 86° F.

(f) Lactose crystals are added, and the product is agitated vigorously for about 1 hour in order to form tiny crystals in the milk and to keep large granules from forming in it.

(g) The product is cooled to about 60° F. and filled into cans; bulk goods are cooled to about 70° F.

(h) The product may be packaged in bulk or in cans. Bulk containers may be steel drums, 10-gallon milk cans or paraffin-lined, white oak barrels, for commercial use. Canned goods may be in 6 to 14-ounce cans or 1-gallon cans.

(i) The preservation of sweetened condensed milk depends upon its sugar content. The sugar increases the osmotic pressure which inhibits the growth of microorganisms; it also "binds" the water, making it unavailable for use by the microorganisms.

(3) Defects in this product are:

(a) Grittiness or graininess - a common deficiency.

(b) Manufacture, handling, and damage - may cause defects in cans.

(c) Microbial spoilage - a factor which may be responsible for:

1. Certain types of molds which, in turn, may cause "buttons" to form.

2. Organisms which may ferment the sugar and cause the can to swell.

3. Organisms which may cause the product to thicken.

4 Organisms and enzyme activity which may cause off-flavors.

d. Evaporated Milk:

(1) Explanation. Evaporated milk is a liquid food made by evaporating whole or skim milk, placing it in a closed container, and sterilizing it with heat. The product is usually evaporated to a ratio of about 2.1:1. It is usually packaged in a characteristic can. It is the largest, single canned food item purchased in the United States. Large quantities are used in formulas for babies and for cooking.

(2) Production:

(a) Raw Milk. While neither Federal law nor specifications require the raw milk used in this product to meet rigid standards, the industry has established a sanitary standards code through the Evaporated Milk Association. Generally, the code requires that:

1. Raw milk be from tuberculosis-free areas.

2. Dairy farms meet certain minimum standards and handle milk under proper conditions.

3 Off-the-bottom sediment tests be made twice a month.

4. The raw milk bacterial count be under 3,000,000.

(b) Processing Before Evaporation:

1. Cooling. Milk must be cooled within 1 hour after milking, unless it is to be delivered to the plant in less than 2 hours after milking.

2. Storage. Milk stored in a plant must be cooled to 50° F., or less.

3. Standardization. Milk may be standardized in the raw milk storage tank or after evaporation. Often the product is standardized to a desirable fat (nonfat ratio in the raw milk tank), then evaporated beyond the desirable proportion. Water is then added to the evaporated milk to obtain the proper ratio.

4. Hot Well Treatment:

a. Heat. The milk is heated to a temperature of about 165° to 210° F. Stabilization of the protein in evaporated milk is important because of the great heat to which the product is subjected in the can.

b. Addition of Salts. Stabilizer salts, such as disodium phosphate, calcium chloride, or sodium citrate, may be added in part to the evaporated milk in the storage tank. The stabilizer cannot exceed 0.1 percent in the finished product.

c. Evaporation. Evaporation takes place in the evaporator or vacuum pan for plain condensed milk; about 2.2 gallons of whole milk are reduced to 1 gallon of evaporated milk.

d. Homogenization. The development of homogenization was a major step forward for the evaporated milk industry. Homogenization takes place after evaporation and is important in preventing fat separation in the can. After homogenization, evaporated milk is placed in storage tanks where some stabilizing salts may be added. A sample of the milk is removed from the storage tank and tested to see if it complies with laboratory requirements.

(e) Filling Tin Cans. The characteristicscan for evaporated milk is called a vent-hole can. Milk passes to a filling machine and is distributed to a number of cylinders located around the outside of the filling machine. If milk is excessively warm at the time of filling, it tends to foam excessively. Milk is filled into the can through small valves through the vent hole. Grooves around the valve permit the release of air from the can.

(f) Sealing Cans. After filling, the cans pass to the sealer where a small drop of solder falls on the vent hole and seals the cans. The solder should not contain less than 30 percent tin; the remainder should be primarily lead.

1. If soldering is not proper (that is, if the content of the lead is either too hot or too high), small pellets may fall into the can.

2. Cans which are not correctly soldered may be removed and sealed by hand.

(g) Testing Cans for Defects. After cans leave the sealer, they may pass through several devices which test them for defects. These testers are usually patented devices.

1. Leak Detector. Detects improperly sealed cans. Some leak detectors blow air into cans. Air inside a can causes it to swell and the can is automatically ejected from the line.

2. Pellet Detector. Detects pellets inside of cans. Usually a can is bumped; if there is a pellet in it, it bounces against the bottom. A highly sensitive microphone picks up the sound which the pellet makes and ejects the can.

3. Underweight Detectors. Detects partially filled cans by passing them over a continuous scale; underweight cans are ejected.

(h) Sterilization of Canned Evaporated Milk. The preservation of evaporated milk in cans depends on sterilizing the product in the can by subjecting it to a heat treatment after filling and sealing.

1. Batch-Type Sterilization. Cans are placed in a retort and heated to a temperature which will destroy all microorganisms. This temperature is usually about 245° F. for about 15 minutes.

2. Continuous-Type Sterilization. In this process, cans are conveyed through the three sections of the sterilizer in the following sequence:

a. The cans enter the preheater and are heated to 200° to 210° F. They stay in the preheater for about 10 minutes.

b. Cans then pass to the sterilizer section where they are he heated to 242° to 245° F. They remain there for about 15 minutes. Because of the heat, cans which are not defective are swollen when they leave the sterilizer section. The device between the sterilizer and cooling section will eject, as defective, cans which are not swollen. Milk from these cans is "cut back" and reprocessed.

c. Cans then pass into the cooling section. Their temperature is reduced to about 95° to 98° F. Cans stay in this section for about 15 minutes.

d. Sterilization temperatures vary with individual plants, can sizes, and the quality of the raw milk that is received at the plant.

(i) Alternate Method. This method is becoming increasingly popular since a fresher flavor is obtained, and the body of the milk is better, when it is used. The milk is sterilized before filling. Equipment varies from plant to plant for the sterilization process. Cans which have been heat-sterilized (about 450° to 500° F.) are filled with hot milk. The sterilized lids close the can in the same way that lids close cans containing fruits and vegetables.

(j) Processing After Sterilization:

1. After sterilization, the cans are coded in accordance with the date of production, passed through a machine which automatically labels them, and are then cased.

2. Cases may be stored upside down in the warehouse; when they are shipped, they may be turned rightside up. The initial turning increases the life of a product. Ideal, long-storage temperatures are temperatures which are below 50° F. and above freezing.

(3) Defects Found in Evaporated Milk. Defects in evaporated milk may be caused by improper manufacturing procedures or by heat-resistant microorganisms. High storage temperatures and humidity increase the development of defects.

(a) Spoilage Caused by Heat-Resistant Organisms:

1. Coagulation. Various organisms cause coagulation of milk; coagulated milk often has abnormal flavor and odor.

2. Gas Formation. Spore-forming anaerobes are among the important gas-producing groups of organisms found in evaporated milk. They may cause a "bulging" in cans; this condition is usually accompanied by coagulation and objectionable odors.

3. Bitterness. Certain microorganisms may make evaporated milk bitter.

(b) Defects Caused by Other Factors:

1. Bulging Cans. Chemical action may cause cans to bulge. Milk acts on metal to combine with iron and release hydrogen. This is likely to occur only during long periods of storage. Filling a can with very cold milk may cause it to bulge at ordinary temperatures.

2. Fat Separation. Improper homogenization or standardizing after homogenization may cause fat separation. This defect usually occurs after long periods of storage. Excessive heat treatment in a hot well may also cause fat separation. The higher the temperature in a warehouse, the greater the opportunity for fat separation. in cans of evaporated milk which are stored there.

3. Salt Precipitation. This defect may occur when cases are stored too long without being turned. Calcium phosphate, appearing as crystalline or gritty deposits, is deposited on the sides of the cans in these cases. If these defects are found in procurement inspections, rejection of the affected items is recommended; if they are found in Government-owned products, these products will not be condemned, but will be recommended for cooking purposes.

4. Protein Precipitation. While storage for an excessive period may cause this condition, it is most often caused by improper stabilization of the protein in the hot well. Protein precipitation usually occurs as a sludge in the bottom of a can. If it is found during a procurement inspection, rejection of the affected items is recommended. If this defect is found in Government owned products, these products will not be condemned, but a recommendation will be made that they be used in cooking.

5. Evaporated milk freezes at a temperature of about 25° F. When ice crystals are formed, they break the emulsion and may cause cans of evaporated milk to rupture.

SECTION I

MANUFACTURE OF DRY MILK PRODUCTS

Dry milks (powdered milks) are dairy products from which most moisture has been removed; their moisture content is usually less than 2.5 percent, as compared with 87 percent water in fresh whole milk. Nonfat dry milk is made by removing fat and water from milk; it retains the lactose, milk products, and milk minerals in a relative proportion to that of the fresh whole milk. Every form of fluid milk product can be converted into powder forms which are available on the commercial market. The use of nonfat dry milk in baking and in producing other items for human consumption has created a market for a product that was formerly fed to animals. Dry milk products are particularly useful in overseas areas where no fresh milk is available. Milk constituents can be conserved more easily since their weight is greatly reduced when dried, and the keeping quality is increased.

1. Manufacturing Dry Milk:

a. Quality of Raw Milk. Raw milk must be sweet and fresh in order to produce a quality, finished product after pasteurizing, condensing, and drying. Sediment and bacterial requirements for the quality of the raw milk supply from individual producers are set forth in the applicable specification, and in the American Dry Milk Institute publication, Sanitary Quality Standard Code for the Dry Milk Industry, Bulletin 915.

b. Processing Before Drying. Raw milk which is not immediately processed is conveyed to sanitary storage tanks. If it is to be held more than 2 hours before it is processed, it must be cooled to 45° F. or less. The milk should be clarified, if necessary, then heated, separated (this is necessary when making nonfat dry milk), standardized, pasteurized, and homogenized before it is dried. Homogenization is necessary in order to insure that the milkfat is distributed uniformly. The cream may be homogenized separately, or the whole milk may be homogenized. It is customary to preheat the milk to high temperatures for short periods before it is dried. The temperatures and the times that are involved must not cause cooked flavors in the product. Preheating produces sulfhydryls which not only prolong the keeping quality of the product but act as antioxidants which help to prevent oxidative rancidity.

c. Drying Process. Immediately before drying, the milk passes through a tubular-type heater where it is preheated and transmitted by a pump to the dryer. In a spray-drying system, the pump is necessary to provide the high pressure which is needed to atomize the milk as it enters the dryer; homogenizers are commonly used for this purpose. The spray, roller, and instantized-type systems are in use now:

(1) Spray-Type Systems: Spray-type systems use a box of cyclone dryers.

(a) Box-Type Spray Dryers. These dryers vary in size. Each is shaped like a box or room, and operates as follows:

1. Preheated milk from the high-pressure pump enters through nozzles into a stream of heated air.

2. Air enters from the outside through filters by means of intake fans. It is passed over radiators which heat it to about 300° F., before it enters the drying chambers.

3. As it comes in contact with the hot air, the spray of preheated milk dries and the powder falls to the floor.

4. A drag removes powder from the floor. Auger conveyors carry powder to the sifter or filler.

5. Hot air from the drying chamber is exhausted through canvas bags and then through filters to theooutside.

(b) Cyclone-Type Spray Dryers. The cyclone-type dryer is shaped like a large funnel or cone and may be 35 to 50 feet high. Milk flows through it in the following manner:

1. The heated milk (at about 145° to 200° F.) is sprayed into the top of the drying chamber where it contacts a current of filtered hot air (about 300° to 400° F.).

2. The air current instantly dries the atomized milk and the powder falls to the bottom of the chamber. The powder is removed via a star valve, while the air is evacuated from the top of the drying chamber.

3. The powder passes from the main drying tower into the powder-air separator where additional air is removed.

4. Powder collected at the bottom of the separator is drawn off, and a cool-air blower system blows it into the powder collector.

5. The remaining air is separated from the powder and exhausted while the powder is removed at the bottom into a sifter.

(2) Roller-Type Systems. Roller-type systems are identified as atmospheric roller dryers and vacuum roller dryers.

(a) Atmospheric Roller-dryer consists of one or two rotating steam-heated drums. Most systems use two center-rotating drums. The flow of milk is as follows:

1. Before it is applied to the drums, milk is normally precondensed before it is dried, and is heated to about 150° to 185° F.

2. Milk is fed onto the drums; the heat inside the drums causes it to dry in a thin film on the surfaces of the drums.

3. This film of dried milk is scraped off with knives, which are located about three-fourths of a turn from the point where the milk is fed onto the drums.

4. The film of dried milk falls into a trough containing an auger conveyor which breaks it into large pieces and then conveys these pieces to a grinder where they are reduced to a fine powder.

5. Powder is immediately filled into bulk containers.

(b) Vacuum Roller-Dryer Process. Only a few of these types of vacuum roller-dryers are in use. They are similar in design to atmospheric roller-dryers. However, processing is done under a vacuum. In vacuum-type roller-drying a much lower temperature - usually about 212° F. - can be used.

(3) Instantized Drying Process. Instantized dried milk is produced in this manner:

(a) A high-quality, spray-dried powder enters the instantizer or aggregator where it is flared into a thin stream of moist atmosphere. As this stream of powder descends, the surface of each particle is slightly moistened to attain a moisture content of about 4 percent.

(b) As the moistened powder falls, it passes through a mildly heated air stream where the turbulent action of the air tumbles the particles into clusters. While clustering or clumping is taking place, moisture is being removed from the surface of the particles.

d. Packaging. Since dried milk products have the undesirable characteristic of absorbing moisture from the surrounding atmosphere, they must be protected from moisture while they are being packaged and stored. Bulk containers, such as barrels, drums, large bags, and consumer-size packages, may be used for packaging. Milk may also be packaged in cans or boxes.

(1) Dried Whole Milk. Dried whole milk, usually "gassed" after filling into containers, contains about 26 percent fat. Gassing keeps a tallowy flavor from developing. (This type of flavor results when fat is reduced by the available oxygen in the product). Gassing also improves the keeping quality of the product. It is performed in two stages:

(a) The first stage draws a vacuum on the product after the powder is placed in the container. This is done through a valve in the top of a storage drum or, if packaged in the delivery container, by the vacuum being drawn before final sealing.

(b) The second stage dissipates the vacuum with nitrogen and immediately seals the container.

(2) Nonfat Dried Milk. This product is seldom gassed, since it has a very low fat content. It may be filled directly into the delivery or storage container (barrel, polyethylene bag, can, or box) and sealed.

e. Solubility of Dry Milks. Dry milks which are reconstituted for beverage purposes should leave no residual sediment. Factors influencing solubility are:

(1) System of Drying. Spray-drying produces particles instantly, and rapid evaporation causes a cooling effect. There is almost no danger of heat damage and protein denaturalization at this point in the process.

(2) Quality of Milk. Developed acidity and coagulating enzymes tend to reduce solubility.

(3) Speed of Removal of Dried Product. Heat may damage the product - possibly causing discoloration and off-flavor - if it is not taken from the drying chamber quickly.

(4) Age. Solubility, which has a tendency to diminish with age, may be retained by low storage temperature and low moisture content.

f. Flavor Defects in Dry Milks. Many off-flavors in dry milks will not develop enough to be detected until some time after they have been manufactured. These recognizable off-flavors are associated with dry milks:

(1) Butyric Rancidity. Excess moisture or action of the enzyme, lipase, can cause butyric rancidity. To insure that this rancidity does not develop, the powder is dried so its moisture content is less than 2.25 percent, the temperature should be controlled properly throughout the process, and the process performed as a continuous operation. The milk is processed so that it flows directly from the concentrating pan to the drier.

(2) Tallowy Flavor. This defect is directly related to the amount of oxygen to which the dried milk has been exposed and to the drying method that is used. Since milk has an affinity for oxygen, it is important to keep the oxygen content as low as practicable, and the catalytic trace metals (copper and iron) to an extreme minimum.

(3) Heated Flavor. Sulfur compounds called sulfhydryls cause this condition. These sulfhydryls are caused by the heat breakdown of whey proteins and the fat globule membrane proteins when the milk is heated in the hot well to destroy the enzyme, lipase, and pathogenic bacteria.

(4) Staleness. An increase in moisture is believed to be responsible for an increase in stale off-flavor. A moisture content of more than 2.5 percent causes a high percentage of the stale flavor in dry milk.

(5) Powdered Flavor. The exact cause of chalkiness or lack of "fresh" flavor is unknown. Some investigators feel that it may be associated with the condition of the fat in milk before it is processed.

(6) Caramelized Flavor. This flavor, caused by a reaction between the amino acids in milk and lactose, darkens the product. It can be controlled by keeping the moisture content below 2.5 percent, and maintaining storage temperatures below 75° F.

g.

g. Reconstitution of Dry Milks. These products will reconstitute most readily if the powder is at about the same temperature at which it was dried (about 130° F.). If the product is to be used at once, water at about 70° F. may be satisfactory. It must be remembered, however, that reconstituted milk is as good a medium for the growth of bacteria as original milk, and if it is held for a period before it is used, it should be reconstituted with cool water or high sanitary quality and stored at temperatures below 50° F.

h. Storing Dry Milk Products. Chilled reconstituted milk, held overnight in the refrigerator, is believed to produce a more acceptable flavor than milk which is reconstituted without chilling. The average consumer does not easily recognize the difference in properly reconstituted milk and fresh milk products. As is the case with other perishable food items, dry products retain their qualities best at low temperatures. High temperatures shorten the shelf life of these products and reduce their acceptability.

i. Defects Developed During Storage. Defects developed during storage may be staleness, caking, darkening, and rancidity. Products with these defects may be used safely in baking if the end product is not adversely affected.

SECTION J

MANUFACTURE AND INSPECTION OF BUTTER

About the same amount of fresh whole milk is consumed throughout the year, but the amount of raw milk that is produced varies with the seasons. Much of the cream used to make butter is obtained in the spring and summer when milk production is high.

1. Requirements for Manufacture of Butter:

a. Quality of Cream. The quality of butter cannot be better than the quality of the cream from which it is made. The cream used to make butter can come from varied sources.

(1) The highest quality butter is made from cream which is separated from surplus Grade A whole milk at the plant.

(2) Cream may also be separated on the farm, but cream separated in this way is usually of lower quality than cream separated in a plant. The reasons for this are that cream which is separated on the farm is handled more, there is a longer period between the time it is separated and the time it is pasteurized, and farms lack adequate cooling facilities.

(3) The quality of gathered cream (a farm-separated cream which is picked up by a creamery truck on a regular-route basis) depends upon the amount of care the farmer gives it and upon the regularity with which it is picked up.

(4) Direct-shipper cream, which is also farm-separated by the farmer, is retained until a sufficient amount is obtained to justify the expense of transporting it. This is usually the poorest quality cream that is used in butter manufacture.

2. Processing Procedures. Cream may be received at a manufacturing plant as whole cream or in milk which must be separated into cream and skim milk. When cream or milk is received at a plant, it is weighed and a sample is drawn for butterfat and bacteriological testing. All illegal cream is eliminated during grading and the cream that remains is pooled into grades of similar qualities. After the cream or milk has been removed from the cans, the cans pass to a can washer for cleaning and the clean

cans are returned to the farmer. Cream which has a high acidity is neutralized. Butter made from high-acid cream will develop undesirable flavors in storage more readily than neutralized cream. Neutralized cream should have an acidity of about .02 to .03 percent. Some common alkalies used for neutralization are sodium bicarbonate, sodium carbonate, calcium hydroxide, calcium oxide, and magnesium oxide. Since over-neutralized cream is a common cause of low-grade butter, the amount of neutralizer added to cream is carefully controlled.

a. Pasteurization of Cream. Cream is pasteurized in order to destroy pathogenic or disease-producing organisms which it contains. Higher temperatures are routinely used to destroy microorganisms which may cause rancidity in butter, and to increase the keeping quality of butter by producing an antioxidant called sulfhydryl. Because of the greater production of sulfhydryls, cream heated to 160° F. for 30 minutes will produce butter with a longer storage life than cream which is only heated to temperatures required for pasteurization. Cream may be pasteurized by any approved method, but the most widely accepted method is vat pasteurization. Any of the types of vat pasteurizers described previously may be used. One of the most common types is the rectangular vat with a coil in the center through which hot water or steam is passed to heat the cream. It is very important to agitate cream properly. If it is agitated too slowly, it will burn. If is agitated too vigorously, it will tend to churn into butter. Other accepted methods of pasteurizing cream are HTST pasteurization and ultra-high-temperature pasteurization. This latter method is apparently becoming more popular than the other one since volatile odors, which may cause downgrading of butter, are removed during this vacuum process. A fine, cooked flavor is desirable in high-quality butter. For this and other reasons, inadequate pasteurization seldom occurs. To determine the efficiency of pasteurization a phosphatase test should be made on the cream as soon as it has been pasteurized. Butter which is several days old may have a false positive phosphatase reading when the test is performed. A reactivation of the enzyme, phosphatase, probably causes this.

b. Handling After Pasteurization. Immediately after the cream is pasteurized, it is cooled by a surface cooler or by a plate cooler by using coolant in the coil pipes of the vat pasteurizer. After cream has been cooled, it is placed in storage tanks until it is ready for churning. Although the grading of cream is not a specification requirement, it is necessary in good creamery operations because it controls the quality of butter that is produced. Cream is graded for three reasons: to group like quality creams in order to produce like quality butter; to eliminate undesirable (illegal) cream which may contain foreign materials, such as dirt and feces; and to determine how much the farmer should be paid (he is paid on the basis of the quality of the cream).

(1) Aging or ripening high-quality cream will insure that butter with a flat taste is not produced. This is a delicate operation since the amount of culture and the time involved in culturing must be exact for proper ripening. In some operations, the starter may be added to the butter when it is worked. The usual procedure is to put the cream in a vat-type pasteurizer and to heat it to about 70° F., which is the incubation temperature of the starter. A culture of desirable organisms known as a starter (usually a strain of Str. lactis) is added to the cream, and the cream is gently agitated to insure that the organisms are distributed evenly. The cream is then incubated from 4 to 5 hours before it is churned. Before the cream is put in a churn, it is heated to a temperature of 46° to 48° F. in the summer, and 54° to 56° F. in the winter.

(2) Numerous styles of churns are used to make butter. Churns are classified according to the materials used in their construction (metal or wood), according to their design (round shape or cube shape), or according to their interior structure (for example, no-roll churns which have no central butter workers).

(3) The purpose of churning is to convert the fat-in-skim milk emulsion to a water-in-fat suspension. This is done by agitating cream to form into larger fat globules and finally into large masses of butter. Churning usually requires 30 to 45 minutes. Of the many theories concerning the way in which churning takes place, the following is probably the most common: Assuming the proper temperature has been reached, the action of churning is the agitation of the cream that causes the fat globules to strike one another and adhere. As the agitation continues, the fat globules become larger and larger and the skim milk (natural buttermilk) is gradually set free until the fat and serum portion are completely separated. The break point is the point at which the butterfat is separated from the buttermilk. When the butter has formed inside the churn, the buttermilk is removed.

(4) After the buttermilk is removed, the butter in the churn is washed to remove any remnants of buttermilk which adhere to the butterfat, to control the body and texture of the butter to some extent, and to help control the composition of the butter.

(5) Depending upon the season of the year and the source of the milk, the color of butter varies from yellowish-white to deep yellow. In the winter months, butter is usually lighter-colored because of a deficiency in the food of the pigment carotene (the source of the yellow color). The color of butter is also influenced by milk secreted by different breeds of cattle. To maintain a constant color in butter throughout the year, a certified color may be added to satisfy market demand. The amount added will vary with the geographic area. In warm climates where the intake of salt is higher, salt is added to butter just before it is worked. Sweet butter is butter that does not have salt added to it; sweet cream butter is made from sweet cream.

(6) After the butter has been washed, it is worked in order to produce a more compact mass of butterfat, to distribute evenly the salt and butter coloring that may have been added, and to expel excess buttermilk and water. Working may be done by the action of rolls or baffles which pick the butter up and drop it to the bottom of the churn. At the time of working, synthetic flavors such as diacetyl, acetylmethycarbinol, or starter distillate, may be added to the butter to improve its flavor. Overworking butter makes it sticky or gummy; underworking it causes it to have a leaky body.

(7) After the butter has been worked, a sample may be taken for a rapid, butterfat analysis. If the butterfat is under 80 percent, further working to remove more moisture will be necessary; if the butterfat is more than 80 percent, water should be added and the butter further worked to lower this percentage. Overrun in butter is the difference between the amount of butterfat in the cream that is used to make it and the amount of the finished product.

(8) When the butter has been worked sufficiently, it is removed from the churn manually and dumped into a tray or cart. Plant employees who remove it manually must wear head coverings and be clean and in good health so their hands, mouths, or clothing do not contaminate it. Butter is usually placed in bulk containers (fiber boxes or wooden boxes) and put in storage at 40°F, or less, so it will harden before it is printed. The churn is cleaned and sanitized after the butter has been taken from it.

(9) Butter may be printed in the plant in which it is churned or it may be shipped to another plant to be printed. Before butter is printed, it is usually necessary to chill or temper it properly to insure it has the necessary degree of firmness.

(10) Bulk butter is removed from its container and the bulk blocks are cut into blocks small enough to go into the hopper of the printing machine. In the printer, the butter is forced out under pressure into the type of desired prints. Butter may be printed in several types or styles such as 1-pound prints, 1/4 pound prints, and

patties. After butter is printed, it is wrapped in parchment paper, waxed parchmentized paper; or a commercial foil paper combination wrapper. It is then placed in master containers and is usually stored with eggs and other dairy products. It will not be stored with strong smelling cheeses, fruits, or vegetables. Fresh butter should be stored at 35° F. and frozen butter at 0° to 110° F. The storage area should have a clean smell and be free from undesirable odors. Butter must always be protected against dust, insects, light, moisture, and mold.

3. Continuous Method of Processing Butter. The continuous method of processing butter is a new system of manufacturing. The manufacturing steps are as follows:

a. Cream is pumped from receiving or storage tanks through an agitating heater where it is heated to about 100° F. The agitating process in the heater brings the cream to a whipped condition which aids in separation. An especially designed separator concentrates the cream to about 86 to 92 percent butterfat.

b. The butterfat concentrate, an oily solution, is then pasteurized in a vascerator at a temperature of 194° to 200° F. and the product is cooled to about 110° to 115° F. and pumped to standardizing vats.

c. The butterfat is then tested and the desired amounts of water, salt, and - when necessary - neutralizer, are mixed into the product. Color and flavoring may be added at this point.

d. The standardized mixture then passes through a chiller which operates on approximately the same principle that a continuous ice cream freezer does. This principle is chilling the butterfat to solid form and working it.

e. The partially-worked mixture then passes directly to a texturator where it is worked and extruded in a continuous-bulk form for bulk packaging or for printing, wrapping, and cartoning.

4. Microbiology of Butter. Microorganisms are important factors in butter since detrimental organisms may impair its quality, beneficial ones may improve the flavor, and - most importantly - pathogenic microorganisms may spread disease. Butter is more resistant to bacterial growth than other dairy products. In attempting to produce sulfhydryls which increase the keeping quality of butter, buttermakers often pasteurize cream at very high temperatures. This not only destroys pathogens, but other detrimental organisms as well; The salt and the starter both have a destructive effect on microorganisms in butter; the starter lowers the pH. Organisms may intentionally be added to butter as "starters;" therefore, coliform, yeast, and mold counts, rather than total bacterial counts, indicate the sanitary conditions under which it is produced.

5. Inspection of Butter. The authority for inspecting butter is the contract, which usually cites inspection requirements and other contractual documents, including the butter specification. Contracts are usually awarded by a contracting officer at a regional Defense Personnel Support Center (DPSC). Deviations, provisional rejections, and other contractual problems must be handled through the regional DPSC headquarters issuing the contract. Sometimes local contracting officers award contracts for commissary resale.

a. Specification Requirements. The product must be purchased from plants listed in the Directory or in the locally approved list. Ingredients of butter must conform to specification requirements.

b. Inspection. Butter is inspected for grade, packaging, packing, and weight requirements. Butter samples are obtained for laboratory analysis.

(1) The product is inspected for proper packaging and packing in accordance with the specification and other applicable documents. At this time the individual-print weights are determined, and the marking and labeling will meet specification and other applicable requirements.

(2) As required by the specification, samples are submitted to the laboratory for butterfat testing. For current requirements and procedures used in the laboratory sampling of butter, the inspector refers to the specification and the DPSC Subsistence Inspection Manual.

6. Grading of Butter. Although grades of butter may be defined in the specification, they are based on descriptions in the USDA document, U.S. Standards for Grades of Butter. The grades are:

U.S. Grade AA or 93 score
U.S. Grade A or 92 score
U.S. Grade B or 90 score
U.S. Grade C or 89 score.

The military services buy all of these grades except the last one.

a. Grading Factors. Butter is graded on the basis of flavor, body, color, and salt. Its grade is determined by first classifying the flavor characteristics of the body, color, and salt. When two or more flavors are involved, the flavor classification must be on the basis of the flavor that carries the lowest rating.

b. Steps in Determining Grades:

(1) The flavor characteristic is identified with its relative intensity in table 1 of the U.S. Standards for Grades of Butter; and the butter is given a flavor characteristic, such as AA or A.

(2) The workmanship characteristics of body, color, and salt and their corresponding disratings are determined in table II of the U.S. Standards for Grading Butter.

(3) Table III of U.S. Standards for Grades of Butter establishes the U.S. grade in accordance with the flavor classification, subject to the total disratings for body, color, and salt.

(4) An example of the above procedure is as follows: A sample of butter has a slight-feed flavor and a slight-storage flavor. It must be given a tentative flavor classification of A since slight storage is lower (A) than slight feed (AA). The sample has a slight-leaky body and slight-wavy color. Since each of these defects has a disrating of 1/2 point, a total of 1 disrating point must be charged against the product. The inspector then goes to table III of the U.S. Standards for Grades of Butter and coordinates the flavor classification of A with the 1 disrating point and arrives at the U.S. Grade B or 90 score.

c. Organoleptic Tests. The senses of smell, taste, sight, and sound may be used in grading butter.

(1) Sound is used to detect leaky butter which sloshes when the plug is removed from a butter sample. Aside from its use for this purpose, sound is used less than the other senses to grade butter.

(2) Sight is used to determine the color of the butter and any observable defects which it may have.

(3) Taste and smell are two very important companion senses used to grade butter. A substance to be smelled must be in volatile form; a substance to be tasted must be in liquid form. This is important in grading butter because if it is too cold it will not volatize, and unless butter is allowed to dissolve in the mouth, it cannot be tasted. Butter must be "sniffed," to be smelled properly. A salty or sweet taste can be detected chiefly on the tip of the tongue, a sour taste on the sides of the tongue, and a bitter taste on the base of the tongue.

d. Criteria for Grading. Certain criteria are required for proper grading.

(1) Preferably, the grader should not eat highly-seasoned food or use tobacco in any form before he tests butter. He should not grade butter for about 2 hours after he has eaten a meal. He will wear clean clothes, be alert, and concentrate only on the grading.

(2) The room in which the grading is done must be well-lighted, well-ventilated, clean, with adequate space, and free from distractions.

(3) The temperature of the butter that is graded must range between 40° and 50° F. A proper trier and a spatula are needed. They must be cleaned before they are used. The amount of butter to grade and the frequency with which each lot is graded are given in the specification and applicable documents for butter.

(4) The trier is inserted at a 45° angle, given a half turn, and carefully withdrawn. The trier plug is then examined for body and color. The aroma of the butter is detemined and a piece of butter is removed from the plug and placed in the mouth so its taste and salt characteristics may be determined. During the grading, the flavor characteristics and body, color, and salt disratings are recorded. After the plug has been examined, it is replaced in the sample and the surface is smoothed over with the spatula. The liners are then folded back into position so the butter is not exposed. The grade of the butter is then determined by the U.S. Standards for Grades of Butter.

SECTION K

MANUFACTURE AND INSPECTION OF CHEESE

Cheese is a dairy food product made from the coagulated portion (curd) of milk. It consists primarily of casein, butterfat, and moisture. Cheese is classified into two broad categories; natural cheese and process cheese. Natural cheese is made by coagulating milk and then eliminating the liquid part (whey) by cooking, draining, and washing the curd. Process cheese is a blend of one or more natural cheeses. The history of cheese dates back thousands of years, and the product is mentioned in the Bible; it was widely used in the Roman Empire. As civilization developed, the use of cheese spread throughout the world, and each country developed its own characteristic cheeses. In 1960, 10.9 percent of the milk produced in the United States was used to make cheese, and about 1,500,000,000 pounds of cheese were produced during the year. The U.S. Government buys great quantities of cheese for the armed forces.

1. Classification of Natural Cheese. More than 800 varieties of cheese are listed in the USDA publication, Cheese Varieties and Descriptions. This publication describes more than 400 cheeses. Many of these cheeses are similar in nature but different in name, depending upon where they were originally produced.

a. Varieties. There are about 18 distinct, basic varieties of natural cheese which are grouped into four major categories: very hard, hard, semisoft, and soft. These classifications are based on the moisture content of the finished product. (See table 9-1.)

b. Hard Cheese. Since hard cheeses contain little moisture, they can be kept almost indefinitely. These cheeses are usually made from skimmed or partly skimmed milk. They can be easily grated and are commonly used on salads, in soups, and with macaroni.

(1) Parmesan, a group of very hard cheeses, originates in Italy. It includes Parmigiano, Reggiano, Lodigiano, Lombardy, Emiliano, Veneto, and Begozza. Parmesan cheese is usually made of partially skimmed cow's milk. After it is manufactured and before it is marketed, it is cured for about 1 year.

(2) Romano cheese, a very hard cheese may be made from ewe's or goat's milk. In the United States it is made from cow's milk. It is usually round, about 10 inches in diameter and 6 inches thick, and weighs 15 to 20 pounds. The methods of manufacturing Romano cheese and parmesan cheese are similar. Romano may be used as a table cheese after it has been cured for 5 to 8 months, or as a grating cheese after it has been cured for a year.

c. Varieties. Hard varieties of natural cheese contain more moisture than very hard cheeses and may be eaten fresh or after they have been cured. Hard cheeses made from unpasteurized milk must be cured for at least 60 days at a temperature of not less than 35° F. before they can be marketed. "American" is a descriptive term used in the dairy industry to denote such hard cheeses as cheddar, colby, granular, and soaked curd.

(1) Cheddar cheese, made from whole fresh milk, accounts for 75 percent of the cheese manufactured in the United States. Cheddaring, one step in the manufacture of cheddar cheese, is accomplished by stacking curd upon curd and allowing them to knit together. After the curd is cheddared, it is milled, salted, hooped, pressed, and ripened, (cured) for varying periods. The word "Cheddar" also refers to a shape or style of cheese weighing 70 to 78 pounds.

(2) Granular or stirred curd cheeses are similar to cheddar cheese except the curd in them is not matted or milled. The curd is cut, stirred, and heated (as in cheddar), and is then alternately stirred and drained. The curd is salted and continuously stirred until it is of correct texture; it is then hooped and pressed as cheddar cheese is.

(3) Colby cheese is similar to cheddar and granular types of cheese but has a softer body and more open texture. Colby cheese and granular cheese are made in much the same way; however, cold water is added to colby cheese to cool the curd after part of the whey has been removed.

(4) Swiss cheese, usually made in "wheels" about 36 inches in diameter, 6 inches thick, and weight 185 to 210 pounds, is a hard cheese with characteristic gas holes or "eyes." Several types of organisms are used in the starter; the propionic acid-forming organism is responsible for the formation of the characteristic gas holes. After the milk has been inoculated with the starter, it is allowed to set in a kettle for about 30 minutes. The creamy layer on top is then pushed back and mixed with the curd later. The curd is cut, forked, cooked, stirred, and dipped from the kettle in a large cloth. The kettles are usually constructed of copper because swiss cheesemakers consider this metal necessary in the production of swiss cheese. Excellent swiss cheese can be made in stainless steel kettles. After curd is removed from the kettle, it is hooped and pressed. Special temperatures must be used during the curing process to produce proper eye formation.

2. Semisoft Cheeses. Semisoft cheeses have higher moisture and a softer and more elastic body than hard cheeses. Very distinct flavors and odors associated with the semisoft cheeses. Semisoft cheeses may be ripened by the action of bacteria on the surface, or by mold or bacteria inside them.

a. Brick Cheese. This is a semisoft cheese which is ripened by bacteria. Its flavor is between cheddar flavor and limburger flavor. The body of brick cheese, softer than cheddar, has an open texture with numerous round and irregular eyes. After the curd is cooked, only a part of the whey is removed. When the curd is as firm as desired, the curd-whey mixture is dipped from the vat, placed into forms, and lightly pressed. The forms are removed the next day and the cheeses are salted and cured. Munster, limburger, and roquefort cheeses are semisoft cheeses.

(1) Munster Cheese. A semisoft, whole milk cheese. The process of making this cheese is similar to the process of making brick cheese. Munster cheese and brick cheese are similar, as finished products.

(2) Limburger Cheese. A semisoft, surface-ripened cheese with a characteristic strong aroma and flavor. While it is being cured, yeasts first predominate on the surface; later, they are replaced by bacteria, Brevibacterium linens, which produce a characteristic reddish-yellow pigment.

(3) Roquefort Cheese. A semisoft, blue-veined cheese, is ripened by the action of blue mold (P. Roqueforti). True roquefort is made from ewe's milk in the Roquefort area in France. Blue cheese, a requefort-type cheese, is made in the United States from cow's milk. A powder containing the mold spores is added to the curd as it is placed into the hoops. Sixty or more holes are punched into each cheese to provide air that will enable the mold to grow.

b. Soft Cheeses. Soft cheeses have a very high moisture content compared to the other natural cheeses. They may be consumed fresh or ripened. The keeping quality of these cheeses is such that they have a very short shelf life.

(1) Camembert Cheese. A soft, surface-ripened cheese which may appear yellow and waxy, creamy, or almost fluid in consistancy. The curd is placed in hoops as soon as it is firm enough to be handled. About two days later, the cheeses are removed from the hoops and salted and they may be inoculated with a culture of mold and bacteria. Camembert manufactured from pasteurized milk is usually cured for about three weeks. If it is made from raw milk, it is cured for at least 60 days.

(2) Cottage Cheese. A soft, unripened cheese made from pasteurized skim milk.

(3) Cream Cheese. A soft, uncured cheese with a milk-like flavor, is made from homogenized pasteurized cream.

3. Manufacture of Cheddar Cheese. The armed forces procures more cheddar cheese than any other kind of cheese. The finishe product does not contain more than 39 percent moisture and not less than 50 percent butterfat in the moisture-free portion. Since most of the substances present in milk are also present in cheese, it is an excellent source of concentrated protein, butterfat, and other milk constituents.

4. Steps in Manufacturing. The quality of the raw milk used to make cheddar cheese determines the quality of the finished product. If poor quality milk is used, poor quality cheese results; if high quality milk is proper processed, it should produce high quality cheese. Raw or pasteurized milk may be used to make cheese. Raw milk is used less now than it was several years ago because it contains many kinds of bacteria which make it difficult to control the quality and flavor of the finished product. Much of the milk used to make cheddar cheese is neither completely raw nor pasteurized. It is called headed milk because temperatures ranging from 5° to 20° F. below pasteurization temperatures are used. Since certain pathogenic bacteria can survive the cheesemaking process and remain viable for varying periods, cheese made from unpasteurized milk may be a source of disease. Cheese made with raw milk must be aged for at least 60 days at temperatures above 35° F. before it can be graded or sold. Because of the increased possibility of survival of pathogenic bacteria, cheese cannot be aged at temperatures above 50° F. This process is called "forced" curing.

a. Use of Pasteurized Milk. Some of the advantages of using pasteurized milk over raw milk are:

(1) The pathogenic bacteria are destroyed;

(2) The manufacturing process is easier to control;

(3) A more uniform product results in each lot;

(4) The chances that off-flavors or undesirable conditions will develop during storage are reduced.

One disadvantage of using pasteurized milk, instead of raw milk, is that it costs more because of the pasteurization process and slower curing. Another disadvantage is that the end-product does not have the sharp flavor that cheese manufactured from raw milk has.

b. Pasteurization. Milk used in cheddar cheese may be pasteurized by heat in any of the pasteurizing units which we have discussed, or it may be pasteurized by a new method called the hydrogen peroxide catalase system. In this method, raw milk is treated with hydrogen peroxide for a prescribed period and at a specified temperature. The peroxide is then deactivated by catalase. An important advantage of this system is that beneficial bacteria, enzyme systems, and many of the desirable properties of raw milk can be retained. Raw milk to be used in cheddar cheese is received in the same way raw milk for the other dairy products is received. It is received at the plant where organoleptic and laboratory tests are conducted. It may then be clarified and standardized to about 4 percent butterfat before it is cooled.

c. Addition of Starter, Color, Calcium Chloride, and Rennet. Starter, color, calcium chloride, and rennet are added after the cheese vat is filled with milk.

(1) Starter. Starter is a culture of bacteria which produces acid, usually lactic acid. The milk is heated to about 86° F. before the starter is added. Proper acidity is required for optimum coagulation of curd in the milk. The amount of starter added to the milk varies, but it is usually less than 1 percent of the milk in the vat.

(2) Color. The addition of color to cheese is optional; however, if color is used, it must be properly dispersed in the milk in order to produce a uniform color in the cheese.

(3) Calcium Chloride. Milk that is low in calcium does not coagulate satisfactorily. Calcium chloride may be added to milk to assist the rennin in forming the curd.

(4) Rennet. Rennet is a commercial preparation of the enzyme, rennin. It is extracted from the abomasum or true stomach of calves, and is used to make most cheese. In combination with proper acidity in the milk, it coagulates the casein to form the curd. The amount of rennet which is added varies, but this amount is usually 2 to 4 ounces per thousand pounds of milk. After proper acidity has developed, the rennet is added to the milk.

d. Setting. Setting is the process of allowing casein to coagulate and form the curd; this process usually takes about 25 to 3[illegible] minutes. As casein coagulates, it entraps butterfat globules and other constituents of milk. The curd that results is mostly casein, butterfat, and water. After a period, the cheesemaker determines whether the curd is ready to be cut. This may be done by inserting an instrument (such as a thermometer) into the product at a 45-degree angle; if the curd splits clean when the instrument is lifted straight up, it is ready for cutting.

e. Cutting the Curd. The curd is cut into small cubes to facilitate the escape of whey. Curd knives consist of wires stretched on frames with a handle on each frame. The wires run vertically in one frame and horizontally in the other frame. The size of the cubes formed by the cutting process should be uniform so the whey will escape evenly. Broken wires cut large cubes which are responsible for an uneven escape of whey and a high-moisture content in the finished cheese.

f. Heating the Curd. When the curd has been cut, the curd and whey in the cheese vat are heated from 30 to 45 minutes at 102° to 105° F. Cooking firms the curd, helps additional whey to escape, and increases the formation of acid. The curd is stirred continuously while it is being cooked to keep it from matting. The temperature is raised gradually from 86° to 105° F. The curd size is reduced to about half of its original size during cooking, since moisture is expelled and acid develops, causing additional shrinkage.

g. Removing the Whey. When the curd is of the proper texture and the desired amount of acid has developed, the whey is removed from the vat by a process called ditching. This process involves placing the curd on both sides of the vat and letting the whey drain down the center of an outlet which is protected by a strainer to prevent the loss of curd. When the curd is ditched, whey escapes more rapidly from the vat.

h. Matting and Cheddaring. After the whey has been removed, the curd is usually 6 to 8 inches deep along the sides of the vat. This curd is allowed to mat together for 10 to 15 minutes. After it is properly matted, it is cut into slabs about 8 inches wide. These slabs are piled on one another (usually about six high) and are turned every 10 to 15 minutes. Because piling the slabs in this way increases the weight on the lower slabs, more whey is pressed from the slabs. Cheese made by this process contains less moisture than similar cheeses made with stirred or washed curd processes. The cheddaring operation is important because it affects the quality of the finished product considerably. Not only can flavor be affected by the production of too much or too little acid, but the body and texture of the finished product can be greatly affected by the matting and the removal of whey.

i. Milling the Curd. When the cheddaring process has been completed, the slabs of cheese are run through a machine called a mill which cuts them into cubical pieces about 1/2 inch in size. Milling permits the further escape of whey, permits the curd to cool faster, and provides more surface area for salting.

j. Washing. In some operations the curd is rinsed after milling to adjust the temperature of the cheese and to remove any whey adhering to the cheese. This is usually done by spraying the curd lightly with a small amount of water and then removing the water.

k. Salting. After the curd has been milled, and in some operations washed; it is spread over the bottom of the vat and forked or mixed until the cut surfaces have dried slightly. Salt is then spread over the curd in two or three applications. The amount of salt that is added varies, but it is usually about 2 1/2 pounds of salt per 1,000 pounds of milk. This results in a salt concentration in the finished cheese of about .05 to 1.05 percent. Salting improves the flavor and seasons the cheese (thus retarding the formation of lactic acid), acids in the removal of whey, and retards the growth of undesirable bacteria.

l. Hooping and Pressing. When the salting has been completed, the cheese cubes are ready to be pressed and formed. Cheddar cheese may be rindless, or rinded and paraffin coated. The hooping and pressing operation is the same for both styles. Hooping is the placing of the curd in hoops or molds lined with cheesecloth. Pressing involves using pressure to form the style or shape of cheese desired. The steps in hooping and pressing:

(1) A hoop is cleaned and a wet press cloth is placed in it.

(2) A starch circle is placed in the bottom of the hoop.

(3) The proper amount of curd is determined by weight and placed in the hoop.

(4) The press cloth is drawn over the curd and the follower is placed on top.

(5) Pressure is applied gradually to about 25 pounds per square inch.

(6) When the cheese has been formed, follower and press cloth are opened, wrinkles in the bandage are smoothed out, and a starch disc is added on the top.

(7) The cheese is placed back in the press at pressures up to 60 pounds per square inch for 14 to 16 hours.

(8) When the pressing has been completed, the formed cheese is taken from the hoop and is packaged as rindless or as rinded and paraffincoated cheese.

(a) Rindless Cheese. To package rindless cheese, the manufacturer removes the formed blocks of cheese from the hoop and cheesecloth and immediately wraps and seals the cheese in a suitable material such as cellophane or a foil. The packaging is then sealed to keep air from contacting the cheese, and the cheese is placed in storage to be cured.

(b) Rinded and Paraffin-Coated Cheese. If rinded and paraffin-coated cheese is desired, the manufacturer removes the cheese from the hoop and cheesecloth and exposes it to the air so that a rind forms by drying the surface of the cheese. Drying takes 4 to 7 days. After the rind has formed, paraffin is applied to the surface of the cheese to protect the cheese, prevent loss of moisture, and prevent mold growth.

m. Curing. Curing is the process of holding the cheese for varying periods under controlled temperatures (35° to 50° F.) and humidities (under 80 percent). During curing, these changes occur: acidity increases, flavor develops, protein changes to a more soluble form, and the body of the cheese changes from tough and rubbery to waxlike.

5. Inspection and Grading of Cheddar Cheese:

a. Contract and Specification Requirements. Authority for the inspection of cheddar cheese is the contract, which usually cites other inspection documents, including a cheddar cheese specification. A contracting officer at a regional DPSC usually awards cheese contracts. Deviations, provisional rejections, and other contractual problems must be handled through the regional DPSC headquarters which issued the contract. Sometimes when contracts are awarded by local contracting officers, the specification stipulates the requirements for the product. The military services may only buy cheese from the plants listed in the Directory or locally approved lists. The ingredients of cheddar cheese must conform to specification requirements.

b. Inspection. Cheddar cheese is most frequently inspected as a finished product rather than during the production processes. It is inspected for grade, packaging, packing, weight requirements, style, and age. The marking and labeling must meet specifications or other applicable documents. Samples are submitted to the laboratory for butterfat and moisture testing. The inspector refers to the specification and the DPSC Subsistence Inspection Manual for current requirements and procedures used for the laboratory sampling of cheddar cheese.

c. Styles and Classes. Styles refer to the shape, design, weight, and method of packaging cheese. There are two major categories of styles (rindless, and rinded and paraffin-coated), and three classes.

(1) Rindless Style:

80-pound block
60-pound block
40-pound block
40-pound block precut into two 20-pound, four 10-pound, or 8 5-pound loaves
30-pound loaves
10-pound loaves

(2) Rinded and Paraffin-Coated Style:

Cheddar	70-78 pounds, 12 1/2 x 11 1/4 inches
Flats or Twins	32-37 pounds, 14 1/2 x 5 1/4 inches
Daisies or Triplets	20-25 pounds, 12 1/2 x 4 1/4 inches
Longhorns	11-13 pounds
Young American	10-12 pounds
Square Print	10 pounds, 7 by 7 inches
Print Loaves	5 pounds, 14 by 7 by 3 inches

(3) Classes:

Fresh or current	Minimum age 30 days for pasteurized, unpasteurized-age 60 days
Medium cured	Minimum age 3 months
Cured or aged	Minimum age 9 months

d. Grading. The standards for grades of cheddar cheese are based on the descriptions in the USDA publication, U.S. Standards for Grades of Cheddar Cheese. The grades of cheddar cheese are:

U.S. Grade AA
U.S. Grade A
U.S. Grade B
U.S. Grade C

The military services buy all of these except Grade C. The cheese is graded on the basis of its flavor, body and texture, color, and finish and appearance. Its grade is determined by first classifying each of the four characteristics and then establishing the final grade on the basis of the lowest rating of any of the four characteristics. The flavor characteristic is identified with its relative intensity in Table V of the U.S. Standards for Grades of Cheddar Cheese. A flavor characteristic, such as AA, A, or others, is assigned in accordance with the corresponding age. The same procedure is followed for body and texture, color, finish, and appearance. The U.S. grade is assigned in accordance with the lowest rating factor of the four characteristics. As an example:

Characteristics	Classification
Sample of Cheddar Cheese is 100 days old	Medium-cured
Slight feed flavor	Tentative Grade A
Body and texture slightly curdy	Grade A
Normal color	Grade AA
Finish and appearance	Grade A

The final grade assigned to this cheese is U.S. Grade A.

(1) Senses Used in Grading. All of the senses are used in grading. Hearing is used less than the other senses. A leaky body may be determined by a "slushing" sound when the trier is removed from the cheese. Touch is very important in determining body and texture.

(2) Criteria to be Observed in Grading:

(a) The inspector should not grade cheese for about 2 hours after he has eaten.

(b) He must wear clean clothes, be alert, and concentrate only on the grading.

(c) The grading room should be well-lighted and well-ventilated, be free from undesirable odors, have enough spacein which to perform the grading, be free from distractions, and have adequate handwashing facilities.

(d) The inspector determines the age and internal temperature of the cheese. Before cheese is graded, cheese samples are tempered from 40° to 50° F. Ch Cheese made from pasteurized milk should be at least 10 days old before it is graded. If it is made from raw milk, it must be kept at not less than 35° F., or not more than 50° F., for 60 days before it is graded. Before an inspector grades cheese, he determines that it is the proper class and style.

(e) The lot sizes and inspection levels of grading and testing each lot are cited in the specification and applicable contractural documents. Cheeses to be graded should be removed from their containers so all surfaces can be thoroughly examined. When examining cheese in cheddars, flats, daisies, and longhorns, first open one end of the container and examine that end, then turn the sample over and expose its sides and opposite end. Cheese in rindless blocks should be removed from its container so that all sides of the wrapped cheese may be examined.

(f) When rinded and paraffin-coated cheeses are examined for finish and appearance, these factors should be determined:

1. Condition of the rind.
2. Condition and smoothness of the paraffin.
3. Cleanliness of the surface of the cheese.
4. Shape of the cheese.
5. Presence of defects, mold, soft spots, and wet rind.

Rindless cheese should be examined for the placement and smoothness of the wrapper, shape of the block, condition of the wrapper, and for such defects as mold and soft spots under the wrapper.

(g) A plug is drawn from the cheese at a 45° angle from the surface and about halfway between the edge of the cheese and the center. Since coloring must be uniform without mottling or faded areas, the plug must be examined. It should also be sniffed to determine its aroma.

(h) Examine the body and texture of the plug. A few mechanical holes are acceptable in a plug, but it should be smooth and free from gas holes. Remove the plug from the trier and bend it to determine its breakpoint and the nature of the break. A plug with a firm body will break sharply and cleanly; a plug that bends and almost forms a circle indicates a corky body. Break a piece from the plug and work it between thumb and forefinger. If the mass works smoothly into a ball, this indicates smooth texture. If the mass is crumbly, falls apart while it is being worked, is pasty or sticky, is weak and mealy, poor body and texture are indicated.

(i) Smell the sample while working it. Working the cheese increases its temperature and enables aromatic gases to escape. Break a small piece from the plug, and taste it to detect its taste and flavor. After tasting, spit the cheese sample out, wash your mouth with water and wait a few minutes before you taste another sample. The top of the plug should then be broken off and replced in the hole from which the plug was drawn. It should be pushed slightly below the surface of the cheese, hot paraffin or paraffin-wax should be placed over the plugged area, and the area should then be covered with parchment or parchment-like paper to protect the cheese from contamination. The final grade of the cheese is determined from the U.S. Standards for Grades of Cheddar Cheese.

6. Manufacture and Inspection of Process Cheese. Process cheese is prepared from a blend of one or more types of natural cheese and an emulsifying agent. The mixture is ground, mixed, and heated into a homogeneous mass. Addition of the following ingredients is optional: acidifying agents, cream, water, salt, artificial coloring and spices.

a. Process Cheese Food. Process cheese food usually contains more moisture and less butterfat than process cheese. The use of an emulsifying agent in process cheese food is optional; otherwise, it is prepared in the same way process cheese is prepared.

b. Process Cheese Spread. This product usually contains more moisture and less butterfat than process cheese food. It is prepared in the same way process cheese is prepared, except that a stabilizer and a sweetening agent may be added to it. Process cheese spread should be spreadable at 70° F.

c. Process Cheese. This cheese is made from natural cheese which will not withstand storage, e.g., a natural cheese with mold may be trimmed and used. During manufacture, the heating process process provides process cheese with better keeping qualities than many natural cheeses. Because of the way it is packed, process cheese shrinks less from loss of moisture than natural cheese does.

7. Ingredients Used in Process Cheese. The types of natural cheeses used in process cheese determine the kind of process cheese that is made. American, swiss, and limburger are frequently used as the natural cheese component; they need not be of high quality to make good process cheese. Specification requirements specify the types and grades of natural cheeses permitted in the production of processed cheese for military use.

a. Coloring. The addition of coloring is optional. If it is used, it must be certified by the Food and Drug Administration. Coloring is used in process cheese to maintain a uniform color.

b. Cream. Fresh or frozen cream may be used to standardize the butterfat content. If cream is added, it should be of high quality, have a pleasing flavor, and have no objectionable odors.

c. Emulsifiers. Emulsifiers are substances which tend to keep fat from separating from cheese while it is being heated. They are usually added during the grinding or heating operation. Examples of emulsifiers that may be used are disodium phosphate, sodium metaphosphate, sodium citrate, and potassium citrate.

d. Salt. If salt is added, it must be clean and free from extraneous material.

e. Water. Water from a potable source may be added to adjust the moisture content of the cheese.

f. Acidifying Agents. These agents, such as citric acid, lactic acid, and acetic acid, may be added to adjust the acidity of the finished product. Acidifying agents must meet the requirements of the Food and Drug Administration.

g. Other Ingredients. Other ingredients, such as pimentos, stabilizers, and other flavoring agents - depending upon the type of product, processing methods, and specification requirements - may be added while the cheese is being made.

8. Manufacture of Process Cheese. The most important step in manufacturing good-quality process cheese is the proper selection and blending of lots of natural cheese.

a. Selecting and Blending. A large number of lots from varying ages of cheese are used to attain uniformity in the finished product.

b. Cleaning. After the lots have been selected, the natural cheese must be cleaned and all rind rot, mold, and damaged areas removed. The cheese is then cut into pieces suitable for the grinder.

c. Grinding. The purpose of grinding is to facilitate mixing, blending, heating, and melting the cheese in the cooker. The grinders shred the cheese into small particles through a heavy metal screen with an auger. After cheese has been ground, it is ready for the cooker. The two most common types of cookers are:

(1) Steam-Jacketed Cookers. These cookers are usually upright and have agitators which mix the melted cheese. Many of these cookers are equipped to draw a vacuum during the cooking process.

(2) Horizontal Cookers. This is the type of cooker most frequently used in this country. It is cylindrical or troughshaped and is equipped with an auger-type agitator which stirs the product while it is being cooked. The cheese, along with the other ingredients, is placed in a hooper at one end of the cooker, and the product is agitated and cooked into a homogeneous mass. The time and temperature of the cooking varies; the minimum time and temperature for process cheese produced for the military services is 158° F. for 30 seconds.

d. Packaging. The process cheese is removed from the cooker and packaged at a temperature of not less than 150° F. Commercial packaging, such as pliofilm, glass jars, cans, or metal foil, may be used. If pliofilm is used as a container, it should be held in shape with a fiberboard box and the hot cheese poured into it. This product is then cooled to 100° F., or less in 24 hours.

9. Inspection of Process Cheese:

a. Before Inspection. An inspector must be familiar with the specification requirements for the product being procured before he performs an in-process inspection! The points to be checked include:

(1) Quality of natural cheese to be used.

(2) Blending.

(3) Condition and quality of the raw materials.

(4) Pasteurization.

(5) Cooking and cooling times and temperatures.

(6) Compliance with packaging requirements.

b. Inspection. In examining a finished product, check:

(1) Type.

(2) Flavor.

(3) Characteristics.

(4) Body (it should be smooth and firm with no pinholes except those caused by steam).

(5) Texture (free from lumps).

(6) Compliance with delivery, packing, labeling, and marking requirements.

(7) Submission of samples to the laboratory for testing in accordance with contractual requirements.

c. Defects in Process Cheese:

(1) Overheating process cheese by using improper emulsifiers or by improper blending, while the product is being processed, may give it a sandy or rough, coarse body.

(2) "Cracking" (This condition is indicated if the cut surface of the cheese exhibits cracks after it has been exposed to the air for a few hours) is caused by faulty manufacturing, improper blending, or improper use of emulsifiers.

(3) If cheese cannot be cleanly sliced at room temperature, this probably means it has been blended improperly.

(4) Poor blending or faulty manufacturing usually produces a weak or pasty cheese.

(5) A hard body results in a brittle cheese which is tough and chewy.

(6) Most off-flavors in process cheese are traceable to bulk cheese. They can be classified in the same way off-flavors in natural cheese are classified.

(7) Gas-forming organisms, which have survived heat treatment, often cause off-odors and off-flavors.

d. Other Processed Cheese Products. Cheddar cheese may be dried by a method similar to the method used to dry milk and requires no refrigeration. Since the product may be reconstituted by adding water to it, most operational rations contain small cans of processed cheese. This product is also packaged in size number 10 cans.

10. Manufacture of Cottage Cheese:

a. Quality of Raw Milk. Good cottage cheese can be made from other grades of milk besides grade A milk. The milk used should be of good flavor, and free from undesirable flavors such as food, malty, unclean and rancid flavors. The milk must also be free from substances which inhibit bacterial growth, such as antibotics or preservatives. Federal specifications CC281 for cottage cheese state the requirements.

b. Separation of Milk. Because cottage cheese is made from skim milk, the milk must be separated as soon as it has been received and before it is pasteurized. If nonfat dry milk solids are to be used, the amount of water removed during drying should be added for reconstitution. Nonfat solids may be added to skim milk to raise the solids content. Cottage cheese is often made from milk which delivery men pick up in stores. Sometimes the results of using this milk to make cottage cheese are excellent; sometimes they are disastrous. The wya the milk was handled in the store determines the condition of the cottage cheese.

c. Cheesemaking Equipment. After the skim milk is pasteurized, it is placed in a typical cheese vat. The vat is jacketed so either warm or cold water may be placed in its wall for heating or cooling. The vat may be equipped with agitators for stirring the product. Curd knives, rakes, scoops, and other equipment will be of sanitary design and not a source of contaminating the product.

d. Addition of Calcium Chloride. Calcium chloride may be added to the skim milk to improve its coagulating properties and to help firm the curd while it is being cooked. It is particularly useful in milk which has had its coagulating properties damaged by pasteurization at high temperatures. The amount of calcium chloride is usually 0.02 percent, or less, of the weight of the skim milk.

e. Methods of Making Cottage Cheese. Two general methods are used to make cottage cheese: the short-set method and the long-set (or "overnight") method.

(1) Short-Set Method:

(a) Characteristics:

1. The incubation, or setting temperature for the milk is usually about 85° to 92° F.

2. About 5 percent of the starter is usually added to the milk.

3. The setting period is about 3 to 6 hours.

4. A coagulating agent, such as rennet, may or may not be added to the milk. In the short-set method, the acid produced by bacteria is the chief cause of coagulation.

(2) Long-Set (or "Overnight") Method:

(a) Characteristics:

1. The incubation or setting temperature for the milk is usually from about 70° to 80° F.

2. About 0.3 to 1 percent starter is added to the milk.

3. The setting period is about 14 to 17 hours.

4. A small amount of coagulating agent, such as rennet, is used more often with this method than with the short-set method.

f. Preparation and Addition of Starter. Good starter-culture control is necessary when making good cottage cheese. The procedures of making starter from a mother culture are about the same as those for making starter for buttermilk.

g. Addition of Coagulating Agent. Small quantities of rennet or a commercial coagulating agent containing pepsin and other enzymes may be added to eht skim milk. For sweet-curd or low-acid cottage cheese, a coagulating agent is necessary. Rennet is usually used at the rate of about 1 ml per 1,000 pounds of milk, and is usually diluted heavily before it is added to the milk. The coagulating agent may be added either before or after the starter is added.

h. Cutting the Curd. The time for cutting the curd is determined by measuring the titratable acidity of the whey. The desirable acidity is about 0.50 to 0.55 percent; the desirable pH is about 4.6 to 4.7. The curd is cut with curd knives in the same way cheddar cheese is cut. Horizontal wires are strung on one curd knife, and vertical wires on another. As these knives pass through the length and breadth of the cheese vat, they cut the curd into small cubes.

i. Cooking the Curd. After the curd is cut, it is heated for 1 to 2 hours at 115 to 120° F. The curd is stirred slowly and gently while it is being heated to help maintain an even temperature throughout the vat. During heating, the temperature is raised slowly, usually about 1° F. every 2 or 3 minutes. If the temperature is raised too rapidly, a rubbery curd will result. Curd is cooked to make it firm so whey can be removed from it.

j. Removing the Whey and Washing the Curd. When the firmness of the curd is suitable, the whey is drained from the vat. A strainer at one end of the vat prevents loss of the curd with the whey. The curd is usually washed in three steps:

(1) The first wash water is usually about 80° to 90° F. The amount of water added should be about the same as the quantity of whey removed. The water should be held on the cheese for 15 to 20 minutes.

(2) The second wash water is usually about 60° to 70° F. It should be held on the cheese for 15 to 20 minutes.

(3) The third wash water is usually about 35° to 40° F., or lower. Water may remain on the cheese for 30 to 60 minutes, or until the curd is completely dhilled. During this time, the curd is agitated, usually with a scoop, so each curd particle is subjected to washing action. The purpose of washing the curd is to remove the whey, to give the cheese a desirable flavor, to firm the curd, and to reduce the temperature.

k. Draining the Curd. After the last wash water is removed, the curd is allowed to drain. It may be drained by "ditching" (piling the curd to the sides of the vat and making a ditch down the center). A draining rack with a perforated bottom will help the draining process.

l. Salting. Salt may be added to the curd to improve its flavor. The amount of salt added should not exceed 1 percent of the weight of the curd.

m. Creaming the Curd. If creamed cottage cheese is made, cream is added after the curd is drained. The cream must be properly pasteurized and must comply with the Federal specification for cream. Enough cream must be added to give the end product a milkfat content of not less than 4 percent.

n. Filling. Cottage cheese may be filled into the consumer cartons either manually or mechanically. Mechanical filling is usually more sanitary.

o. Cooling and Delivery. Immediately after cottage cheese is manufactured, it is cooled to 45° F., or below, and held at that temperature until it is delivered. The product should be delivered to the military installation within 72 hours after it is made.

11. Inspection of Cottage Cheese:

a. Finished Product Requirements. Cottage cheese should be a wholesome commercial product of pleasing flavors. The coliform estimate should not exceed 10 per gram. The combined yeast and mold count estimate should not exceed 10 per gram. The moisture should be properly pasteurized. If creamed cottage cheese is procured, it should have a milkfat content of at least 4 percent.

b. Defects in Cottage Cheese. Some of the defects which may occur in cottage cheese and their causes are illustrated in table 5-2.

c. Sampling for Laboratory Testing. Representative samples of cottage cheese will be collected in the original container. To avoid contamination, the container should be unopened when it is submitted to the laboratory for analysis. The sample will be identified, cooled immediately to 50° F., or below; and kept at that temperature until it is received at the laboratory.

d. Sanitary Control. When excellent sanitation conditions prevail, the cheese should have a shelf life of from 14 to 21 days, or longer. When sanitary conditions are poor, the shelf life may be only 3 to 5 days. Some important factors that enter into the sanitary control of cottage cheese are:

(1) The quality of the raw milk and cream used.

(2) Contamination - following pasteurization - from vats, agitators, pipes, filters, or other equipment.

(3) The growth of undesirable bacteria during incubation. (Contaminated cultures or contamination after pasteurization may cause these organisms.)

(4) Contamination from the wash water.

(5) Contamination from hands during creaming or filling.

(6) Contaminated packaging material.

(7) Excessively high packaging temperatures.

(8) Excessively high storage temperatures.

12. AFM 74-13, Appendix A, Procurement Quality Assurance for Fresh Dairy Products," sets forth guidelines to assure uniformity in the administration of the procurement quality assurance provisions of contracts for fresh dairy foods and is applicable to all DOD personnel. This supplement implements Armed Services Procurement Regulations (ASPR) paragraph 14-501 which pertains to special subsistence commodities. The basic concept of the Procurement Quality Assurance Provisions is that of obtaining an acceptable degree of government procurement quality assurance by relying on the contractor's performance with a minimum cost to the government itself. The wholesomeness assurance procedures of AFM 74-15, Appendix A follow the guidelines of the Grade A Pasteurized Milk Ordinance. Since practically all results of testing of fresh dairy products are "after consumption" data, results of tests will be primarily used to determine if contractor's processes are sufficiently controlled to produce products meeting contract quality requirements of the government. The government intends to rely upon the contractor's system of inspection but reserves the right to notify the contractor's system of inspection but reserves the right to notify the contractor when his system is deemed unreliable. Government personnel should not discuss or disseminate any information concerning contractor other than with concerned personnel of the Military Departments. Quality history files for each contractor will be the management tool to determine the contractor's quality control reliability. You should become completely familiar with the H-57A and use it for guidance when dealing with fresh dairy product inspection.

SUMMARY

Fresh milk is the basic ingredient of all dairy products. The U.S. Public Health Service defines milk as the lacteal secretion, practically free from colostrum (lacteal secretion obtained immediately before and after calving) by the complete milking of one or more healthy cows. The approximate composition of milk is: water, 86.9 percent; fat, 3.9 percent; protein, 3.2 percent, lactose, 5.1 percent; minerals, .9 percent; and vitamins, enzymes, gases, body cells, bacteria, trace elements, and other nitrogenous material. Important properties of milk are acidity, color, flavor and odor, specific gravity, stickiness, surface tension, and viscosity.

Bacteria may be classified according to optimum growth temperature. The four classifications are psychrophilic (cold-loving), mesophilic (medium-temperature-loving), thermoduric (heat-resistant), and thermophilic (heat-loving). It is impossible to determine the exact number of bacteria in a sample of milk; bacterial counts are only estimates at best. Official methods of conducting bacteriological tests on milk are contained in the American Public Health Association publication, Standard Methods for the Examination of Dairy Products.

Milk and other dairy products which are procured for the military services must meet certain general requirements. These requirements are that the product shall be:

a. free from pathogenic bacteria;

b. free from harmful or toxic substances;

c. clean and free from extraneous materials;

d. normal in composition;

e. low in bacterial count;

f. good in flavor;

g. good in keeping quality; and

h. originated from approved sources.

An effective sanitary control program against the spread of milk-borne disease is based upon the establishment and enforecment of sanitary standards; the education of producer, processor, and consumer in the essentials of a safe milk supply; and an efficient inspection, which includes a laboratory testing program.

A set of documents, known as the 3-A Sanitary Standards, provides desirable standards for the design, construction, materials, and capabilities of milk plant equipment.

An inspection system which begins on the farm and continues through the processing plant is necessary in order to establish and maintain quality controls. Standards are specified in contracts which involve the military services. As an inspector, you must know what a contract calls for if you are to determine the inspections that are necessary.

Ingredients which may be used to make ice cream, sherbets, and ices are milk products, sweetening ingredients, flavoring ingredients, egg products, coloring ingredients, stabilizers, emulsifiers, salt, water, and acids.

The steps involved in making ice cream are the receipt and storage of ingredients, combining and mixing of ingredients; pasteurization; homogenization; cooling; storage; flavoring; freezing; bulk flavoring; packaging, hardening, and storage.

Sanitary standards for ice cream plants are comparable to these standards for plants which process other dairy products. Members of the military veterinary services must inspect and approve plants which supply ice cream to the armed forces.

Concentrated dairy products, known in the industry as processed milks, are milk or milk byproducts from which some water has been removed. Dairy products are concentrated in order to reduce transportation and warehouse space, and to create items which are easier to merchandise than fresh milk. Fluid concentrated dairy products include plain condensed milk (whole or skim); concentrated whole milk (for reconstitution); sweetened condensed milk (whole or skim); evaporated milk (whole or skim); condensed buttermilk; semisolid buttermilk, condensed whey, and ice cream mix paste. Dry milks (powdered m milks) are dairy products from which most moisture has been removed. Every form of fluid milk product can be converted into powder forms which are available on the commercial market.

The highest quality butter is made from cream which is separated from surplus Grade A whole milk at the plant. Cream which is separated on a farm is usually of lower quality than cream which is separated in a plant. The quality of gathered cream (a farm-separated cream which is picked up by a creamery truck on a regular-route basis) depends upon the amount of care which the farmer gives it and upon the regularity with which it is picked up. Direct-shipper cream, which is also farm-separated, is retained until a sufficient amount has accumulated to justify the expense of transporting it; this is usually the poorest quality cream that is used to make butter.

The authority for inspecting butter is the contract, which usually cites inspection requirements and other contractual documents, including the butter specifications. Butter must be purchased from the plants listed in the Directory, or in the local approved list. Butter grade is first determined by classifying the flavor characteristics, and then classifying the characteristics of the body, color, and salt. When two or more flavors are involved, the flavor classification must be based on the flavor that carries the lowest rating.

Cheese is made from the coagulated portion (curd) of milk. It consists chiefly of casein, butterfat, and moisture. It is classified in two broad categories: natural cheese and process cheese. Natural cheese is made by coagulating milk and then eliminating the liquid part (whey) by cooking, draining, and washing the curd. Process cheese is a blend of one or more natural cheeses. There are about 18 distinct, basic varieties of natural cheese which are grouped into four major categories; very hard, hard, semisoft, and soft. The armed forces procure more cheddar cheese than any other kind of cheese. The ingredients of cheddar cheese must conform to specific requirements.

The types of natural cheeses used in process cheese determine the kind of process cheese that is made. The most important step in making good-quality process cheese is the proper selection and blending of lots of natural cheese. Before he performs an in-process inspection, an inspector must be familiar with the specification requirements for the product being procured. In examining process cheese as a finished product, he checks the type, flavor, characteristics, body, texture, and compliance with delivery, packing, labeling, and marking requirements.

Good cottage cheese can be made from other grades of milk besides Grade A. The milk used should be of good flavor, and free from undesirable flavors such as feed, malty, unclean, and rancid flavors. Two general methods are used to make cottage cheese - the short-set method (in this process, the setting period is about 3 to 6 hours) and the long-set method (the setting period is about 14 to 17 hours).

274

PREPARE THE MAN

STUDENT TEXT 3ABR90830-IX-1

3OBR9921-1-II-7a

DEPARTMENT OF VETERINARY MEDICINE

INSPECTION OF WATERFOODS

1-4

July 1974

SCHOOL OF HEALTH CARE SCIENCES, USAF
SHEPPARD AIR FORCE BASE, TEXAS

Designed For ATC Course Use

DO NOT USE ON THE JOB

The fins are used by the fish for locomotion and stability in the water.

Another important point of anatomy is the gills. These are located on either side of the fish's head. They are the breathing organs of the fish, exchanging oxygen from the water for carbon dioxide. Located in the gill area are gill rakers and the gill cover. The "rakers" are used for filtering the water prior to entering the gills and the "cover" is a protective device for both the gill membranes and the "rakers." (See Figure 1)

The neck area is referred to as the nape. This portion is often removed in certain forms of fish.

The caudal peduncle is the meaty portion of the tail. It is normally a narrow and thin portion and like the nape is often removed.

The term poke refers to the fish's abdominal area and contains the fish's viscera or guts.

The eggs of fish are referred to in the waterfoods industry as roe. They are sold commercially in the form of caviar.

These are just a few of the terms you may hear associated with the inspection of waterfoods. With this knowledge, you should be able to intelligently confer with other persons as needed in your job as a waterfoods inspector.

2. Nutritional Value of Fish.

One of the major reasons the military procures waterfood products is its nutritional value. There are two nutrients we will discuss, proteins and fats. The fish is an excellent source of protein, exceeding the protein value of beef. A point of interest about fish proteins is that they are water soluble and careful consideration should be given to processing and preparation.

Another of the nutrients is fat. Fish fat, unlike most food animals, is in an oil form, low in calories, and contains vitamins A and D. This nutritional fat often leads to storage problems, an aspect to be discussed later in this chapter.

3. Other Waterfoods Inspection Agencies.

As with all food products, the military inspector should be familiar with other federal agencies working with the waterfoods industry. The U.S. Department of Commerce, the ultimate federal waterfoods inspection agency, publishes the Guide to Federally Inspected Fishery Products (GFIFP). This guide contains the names and locations of plants having a USDC inspector present during processing. Producers listed in this publication are not required to be listed in the Local or Army Area Approved Sources Directories.

Shellfish producers not listed in the GFIFP may appear on the Interstate Shellfish Shipper's List published by the U.S. Public Health Service. Products received from establishments on the USPHS list and not in the GFIFP must appear in a Local or Army Area Approved Sources Directory. The USPHS is responsible for certifying the waters from which shellfish are harvested.

The military is responsible for inspection of the product as required by the applicable specification, inspecting for sanitation during processing of the products, and maintenance of approved establishments on the "Local Approved List" as well as "Army Area Directories."

4. Process Inspection.

Finally, you will assist in maintaining surveillant inspections over the procurement and distribution of all waterfoods consumed by Air Force personnel.

In performing inspections of fresh and frozen fish, first identify the product and insure it is the intended item for purchase.

After confirming the identity, check the product's condition. Is the product wholesome and of the desired high quality?

The purchase instrument will designate the species of fish; therefore, the next step is to properly identify the product. Considering the fish's color often changes shortly after death; color cannot be utilized as an accurate method of identification.

Fins are an accurate method of identifying a species, i.e., location of a fin, its structure, and how many fins there are on the fish. Confirm the identity by checking these characteristics described for a given fish against those exhibited by the fish you are examining for identity.

The next step, after identifying the species, is determine the condition of the product. Proper handling is a must with this highly perishable product and since deterioration begins immediately with death, extreme care must be exercised to prevent accelerated deterioration. A very small amount of deterioration often results in off odors and flavor.

Three changes occur after the death of fish, rigor mortis, autolysis, and putrefaction. Rigor mortis will be the first observable post-mortem change in the fish and it appears as a stiffening of the fish's body. This change results from a biochemical process that is interrupted by death and the breakdown results in an accumulation of lactic acid in the muscles of the fish causing the flesh to toughen. The stiffness is believed to result from a chemical reaction between various proteins in the fish flesh.

Regardless of the theories as to the hows and whys of rigor, the inspector needs knowledge of the more practical aspects such as: Is it good or bad; how long does it last; what can we do to prolong this state in dead fish?

Rigor in a fish is a good sign. Since it is the first post-mortem change, it indicates that a fish is fresh and fish processed in the state or rigor make good quality products. The lactic acid present in the flesh has a bacteriocidal effect; therefore, spoilage from bacterial action is reduced and held to an acceptable level. This action also helps in maintaining storage quality of the processed product.

Knowing that rigor is a good state for fish products, the inspector must know how to prolong this condition. The duration of rigor is varied depending on several conditions of which one is the fish size. The inspector has little control of this but can anticipate a faster onset of rigor in smaller fish. A good inspection tool to remember is "the larger the fish the slower the onset of rigor."

Another consideration in prolonging rigor is the methods fish are handled. If fish are handled roughly, bruising and tearing will take place, and bacteria will enter the flesh. Also, excitement or struggle prior to the death of the fish will cause a faster onset of rigor. The slower the onset of rigor, the longer the state of rigor will be maintained; thereby producing a longer period of time the fish will remain in a "fresh" state.

As with most food products, the temperature of the fish is most important. Continuous low temperatures are best for prolonging the onset and duration of rigor; therefore, 32°F is considered to be an excellent holding temperature for fresh fish. Fish are cold blooded; therefore, lower temperatures than normal are needed to reduce the growth of the cold loving bacteria present in the fish.

Rigor is an indication of not only how recently the fish was harvested, but also if often indicates how well or poorly it was handled prior to and after death. The inspector must become familiar with the catch methods of the area and the refrigeration techniques used on board the harvesting vessels.

The second observable state the fish enters is termed autolysis. This is a period of self-digestion, caused by enzymes attacking the fish cells. Chemical methods of testing for autolysis are complex and not reliable; therefore, we must use organoleptic means for determining the degree of putrefaction or spoilage. A fish product frozen while in the state of autolysis, when thawed, will continue to undergo putrefaction. Handling of fish in this condition in an expeditious manner is of great importance.

The inspector should be especially cautious about accepting or utilizing fish in an autolytic state.

The final stage of decomposition is total putrefaction. At this point, the fish should no longer be considered as a food source and for a better understanding of freshness, consider all stages, fresh, stable, putrid. Figure 2 provides a comparison of observable characteristics.

The fat, observed as an oil, may also begin to break down at death. This oxidative change is the result of fat splitting enzymes. Some fish fats/oils will oxidize even though they are frozen; therefore, take special care to examine for rancidity during in-storage inspection. If the fish are rancid, they will have a bitter flavor leaving a soapy taste. The odor will be strong and pungent and the color will change from clear to yellow and then to brown.

5. Parasites.

Fish, like most animals, are plagued with parasites. Most of these parasites are not transmissible to man and, therefore, are not a significant health problem. The presence of these parasites is often a rejection factor based upon impaired quality and/or esthetics.

Parasites are discovered by use of a fish candler. Fish products procured by the military receive routine candling because of the frequency of parasitism. The requirement for parasite tolerances are found in the appropriate specification, and if the product exceeds the tolerance, the vendor may be allowed to remove the excess if it does not mutilate the product.

The only known fish parasite transmissible to man is the Diphyllobothrium latum or the fish tapeworm. It appears as a cyst, located just under the skin. It is found mostly in the Pike and Pickeral species

6. Specification Requirements.

Most fish procured by the military are purchased in accordance with Federal Specification PP-F-381. The inspector will rely upon this document for guidance and to determine acceptability of the product. The specification covers two general areas; types and forms, with type referring to the state of preservation. Type I are fish marketed in a chilled state and Type II are marketed in a solidly frozen state. There are six forms of fish supplied to the military.

Form I - Whole or round
Form II - Dressed
Form III - Fillets
Form IV - Steaks
Form V - Chunks
Form VI - Portions

The specification considers more details on how these are to be processed. The specification also lists the requirements for storage of frozen fish.

7. Preservation Methods.

There are several methods of preserving waterfoods. Chilling, freezing, salting, drying, and canning are some of the most widely used in the industry. Chilling is the most common method of preserving fresh fish as they are chilled from time of harvest through processing.

The preservation method most commonly seen by military inspectors is freezing. There are several methods of freezing, i.e., blast freezing, plate freezing, glazing. The use of rapid freezing methods (-40°F or lower) produce a better quality product because upon thawing, slowly frozen products often lose natural juices and nutrients as a result of cell damage. Fish flesh begins freezing at 30.3°F.

Blast freezing is an example of quick freezing as it utilizes cold, circulated forced air. Proper air circulation is an important consideration when preparing the product for placement in the blast freezer.

Plate freezing is another quick freeze method. The fish are packaged, then pressed between two extremely cold plates, thus reducing the heat content from both sides. This method, used for fillets and steaks, results in a neat, formed package.

Glazing is an often used process and is especially useful in protecting the frozen product from freeze dehydration and oxidation. A thin layer of ice is formed around theedges of the product, preventing air contact with the product. This process is accomplished by exposing the frozen product to cold (34°-38°F) potable water.

The storage temperature is the most important factor in maintaining the quality of frozen fish. In order to maintain quality, a storage temperature of 0°F or lower must be maintained. Fish stored at -10°F will be noticeably higher in quality than those stored at 0°F. Fluctuating temperatures and low relative humidities encourage dehydration and deterioration in frozen fish.

Another major method of preserving waterfood products is salting. Salting is the most important method of fish curing and is used in nearly all methods of curing as a flavoring agent. Salting preserves fish by extracting water, thereby making them less subject to spoilage. Care should be taken in salting fish to prevent oversalting.

Another method of preservation is drying. Drying may be accomplished by using smoke alone or in conjunction with salt. Again the preservation principle is based upon the removal of moisture.

Canning is another preservation method used by the waterfoods industry. A review of Food Preservation and Canning will provide an insight into the canning process. One fish product, salmon, is cooked after the canning process.

8. Inspection of Fish.

The following paragraphs contain some points to examine on classes of inspection. In an ideal situation, watch the fish being caught and follow through on every step involved until the fish is packaged. In most cases, the product will not be seen by the inspector until it is offered in packaged form. While we will not attempt to review each class of inspection separately, information is provided to help the inspector in his/her duties. Prior to any procurement inspection, several items are needed, i.e., purchase instrument, applicable specification and amendments, applicable commodity clauses and articles, and applicable specifications for packaging and packing.

At origin, check not only the type, species, and grade, but also the methods of manufacture and sanitary conditions in the plant.

In a class 4 inspection, be interested in quality and condition. To determine if the product is insanitary or unsound, examine for evidence of rancidity, thawing, refreezing and contamination through breakage of boxes and adulteration. If an obvious error has been made in type, species or grade, or if a substitution is suspected, recommend provisional rejection of the product.

In class 5 work, be primarily interested in the condition of the product and in protecting the Government's interest against damages occurring during storage and shipment. If the fish shows evidence of serious storage deterioration, but is still fit for human consumption, advise the commissary officer, and recommend immediate issue.

In a class 7 inspection, determine, at the time of issue or sale, the wholesomeness and palatability of the fish. It may be necessary to perform an organoleptic examination.

For a class 8 inspection, check for quality and condition and determine if the product is from an approved source.

In a class 9 inspection, examine the product for off-conditions. Recommend the issue of fish that are showing deterioration or storage damage, and check to see that proper storage conditions are being maintained.

With the knowledge gained from this section, the inspector should be equipped to perform origin as well as in-storage inspections. Always be aware of the post-mortem changes affecting the quality and conditions of the products procured for use by the military services. It is the veterinary inspector's responsibility to insure that Uncle Sam gets what is paid for, i.e., the highest quality waterfoods possible.

SECTION B - CRUSTACEANS (SHRIMP)

Shrimp are becoming more and more popular as a food item in the military diet. They are classified as a Crustacean along with such other shellfish as Crab and Lobster. Some of these Crustaceans are procured by the military, but shrimp are most abundantly procured. Shrimp are a high source of protein and provide a tasty variation for the diet.

1. Anatomy of Shrimp.

As with fish, anatomy will be the first area covered in the study of shrimp. Without a basic anatomical knowledge, the inspection of shrimp would be most difficult. Figure 3 is a diagram of a shrimp with important anatomical parts identified. Listed below are some of these parts and the functions they serve in the shrimp.

The head contains all the internal functional systems, except the intestinal tract, and is usually removed prior to icing aboard the vessel.

The tail is the edible portion of the shrimp and may be prepared and processed in several ways.

The intestinal tract is known as the sand vein, is removed in most prepared shrimp, and is found along the back of the shrimp. A shrimp which has had both the shell and sand vein removed is referred to as peeled and deveined. (P&D)

2. Species of Shrimp.

There are three species procured by the military: white, brown, and pink shrimp.

White shrimp are the most expensive because of the soft texture of the flesh. They can be identified by the tail being edged in green. When spoiled, this shrimp will turn a brownish or reddish color. These species are caught offshore during the day.

The other species are very similar, both having a grooved section on the tail appearing on the last segment. See Figure 4 for a view of this point of identification. The brown shrimp is the largest of the varieties procured by the military while pink shrimp have a distinctive pink spot on the meat, midway along the tail. These grooved species are caught at night in deep water.

All species of shrimp spawn in shallow water during the early spring and then die. The new crop first appears on the market during June and July. The remaining shrimp work their way back to deep water.

3. Processing of Shrimp.

Shrimp die soon after leaving the water so immediate processing is of utmost importance. Most are harvested using the otter trawl method, resulting in large catches of schooling shrimp. As a result of the sudden death of shrimp, the processing begins on board the shrimping vessel.

The first processing step, after landing, is normally the removal of the head, thus removing all the internal systems of the shrimp except the intestinal tract.

The next processing step is to ice down the shrimp to lower the internal temperature and reduce spoilage. Shrimp may be either chilled at this point or frozen. If the chilling method is to be used, the procedure is four (4) inches of ice, four (4) inches of shrimp, and four (4) inches of ice.

If freezing is to take place at sea, certain procedures must be followed to prevent quality loss. The shrimp will be culled and washed and then placed in a circulating brine enhances rapid freezing and cuts down on salt penetration of the flesh. The shrimp are removed from the brine and stored at 5°F or lower.

Within five days after the vessel arrives in port, the frozen shrimp must be stored at 0°F or lower. Within six weeks after the initial freezing on board the vessel, the frozen shrimp must be further processed. To properly thaw frozen shrimp, circulating water is used at not more than (NMT) 60°F and removed within 15 minutes.

There are several methods of preparation of shrimp for military procurement. Shrimp prepared in accordance with (IAW) Federal Specification 316, Shrimp, Raw and Cooked, Chilled and Frozen, are described in types, forms, and styles. Type refers to the state of preparation, raw or cooked. The form determines if the shrimp is to be peeled or not, while the style indicates whether or not the sand vein is to be removed. This information will be indicated on the purchase instrument.

Another method of preparation of shrimp is breaded. Breaded shrimp are processed IAW Federal Specification 315, Shrimp, Frozen, Raw, Breaded. With the addition of batter and breading to the product, increased care must be taken to insure the quality and wholesomeness of the end item

In processing shrimp for breading, the iced shrimp are immersed in water with internal temperature not to exceed 50°F. Frozen shrimp may thawed using circulating potable water with the internal temperature of the product not to exceed 40°F unless continuous processing is used, then the temperature may go to 70°F. The internal temperature of the product cannot be above 40°F for more than one hour during processing. This hour is to include the peeling, deveining, and coating.

The peeling and deveining having taken place, the breading process begins. All shrimp for military use will be mechanically breaded because hand breading is not allowed. The batter used in the breading process will not go above a temperature of 50°F and has a shelf life of 8 hours. Batter over 8 hours old is not acceptable. There are three ranges for coating content of breaded shrimp.

Range 1 - NMT 30% breading by total weight.
Range 2 - Over 30% but NMT 40% by total weight.
Range 3 - Over 40% but NMT 50% by total weight.

The formula for computing the percent breading is:

$$\frac{\text{Breaded Weight - Unbreaded Weight}}{\text{Breaded Weight}} \times 100$$

4. Grading of Shrimp.

Shrimp must be graded. There are three grades for shrimp as stated in U.S. Standards for Shrimp. These grades are derived from a numerical total value remaining after subtracting points assigned to defects found. See Figure 5 for these defects and their point value. The three grades and score requirements are:

US Grade A or US Fancy - NLT 90 points
US Grade B or US Good - NLT 80 points
US Grade C or US Commercial - NLT 70 points

The military procures only US Grade A and US Grade B. Organoleptic examinations for flavor and odor are also considered in grading shrimp.

5. Sizing of Shrimp.

Shrimp are sized according to count per pound. It is important to correctly determine the weight of the shrimp and not excess water absorbed during washing. Allow about 2 minutes for draining prior to weighing. The count per pound is also important to food service personnel as they depend on a certain number of shrimp per man per meal. The applicable specification will state the tolerances for shrimp sizes.

6. Defective Shrimp.

The culling process mentioned earlier is used to remove these poor quality or damaged shrimp. One of the more commonly found defects is tigering and is the result of an enzyme blackening the membrane connecting the shell segments. Tigering does not affect the flesh, but is undesirable and should not be accepted for military products if found in excess. The addition of the chemical, sodium bisulfite, to the ice will help prevent this condition.

Another defect is the cotton shrimp and the cause for this condition is not known. Shrimp exhibiting the signs of a cotton shrimp (soft, opaque, and gelatinuous flesh) should not be accepted.

The odor of shrimp is an excellent inspection point. The odor should be fresh and characteristic of shrimp. Occasionally shrimp may feed on certain seaweed and develop an odor of oidoform. Although this does not indicate spoilage, it does reduce the palatability of the product. Shrimp with a pronounced odor of iodoform should not be accepted.

Since shrimp are procured in larger amounts than any other waterfoods product, it is important to remain alert for improper processing or storage, thus preventing a loss of money to the Government. Proper rotation of Government owned stocks is a mandatory responsibility for each veterinary inspector.

SECTION C - MOLLUSKS (OYSTERS)

The least procured waterfood is the mollusk, of which the oyster is a specie. Even though they are procured in small quantities, the veterinary inspector may be called upon to perform an origin inspection on this product. Know something about where oysters grow, how they are harvested, processing, as well as the defects often observed upon inspection of the product.

1. Anatomy of Oysters.

The inspector needs to know basic anatomy in order to insure that the product does meet the requirements. Some of the basic anatomical features of the oyster are discussed in the following paragraphs. (See Figure 5)

The shell serves as a home and provides protection for the oyster.

The palps of the oyster serve as the lips and are lined with cilla that help force food toward the mouth.

The oyster breathes through its gills. This is the site where oxygen is exchanged for carbon dioxide.

The two halves of the shell are held together by the adductor muscle. This muscle enables the shell to open and close.

2. Habitat and Harvesting.

Oysters live in shallow, brackish water in areas called beds. Brackish water is found where salt and fresh water meet. Oysters will live in polluted waters, so the inspection of their habitat is very important. Oysters usually spawn during the summer months. During this period, this oyster meat has an off-flavor; however, this is not an indication of spoilage.

The system of capturing oysters is called harvesting. Dredging and hand tonging are the two methods used to harvest oysters. Dredging is used primarily in privately owned beds. Large numbers are harvested in one operation using this method. This requires intensive reseeding efforts in order to maintain an adequate commercial supply.

Hand tonging is the only method allowed in state maintained, public grounds; however, this slow process is not practical commercially. Public grounds are not reseeded often and are primarily for use by the general public.

3. Processing of Oysters.

As the military procures mostly shucked (shells removed) oysters, this discussion will cover only the processing of shucked oysters. The first step in processing, after removing the oysters from the boat, is to wash them thoroughly preventing contamination of the edible product.

The next process is shucking, or removing the edible meat from the shell. The oyster meat will remain intact during further processing and none of the internal systems are removed. Care must be exercised during shucking to prevent damage to the meat. The meat is usually removed with the aid of a knife.

The oyster meat is then washed again to remove any sand or shell fragments which may be adhering to the meat. This washing process is termed "blowing" because the water is agitated with air. Draining of the oyster for about two minutes is required after the blowing operation.

To be considered a fresh oyster, the product must meet certain requirements. One requirement is that the oyster must be chilled to 45°F within four hours of shucking. They must be lowered to an internal temperature of NMT 40°F within six hours after shucking and must be maintained at this temperature until delivery. Fresh oysters cannot have been in contact with water for more than 30 minutes during processing. The time the oyster spends in the "blowing" wash is doubled when computing the total water contact time of 30 minutes. The amount of time the oyster is in contact with water is regulated to prevent excessive absorption of water. The fresh oyster then must be delivered within 120 hours of shucking.

To be considered a frozen oyster, the product must be lowered to 0°F within 24 hours of shucking and be maintained at this temperature until time of delivery, at which time they must not be more than 180 days old.

Specification Requirements.

In addition to the requirements for fresh or frozen oysters, there are Federal Specification requirements for products procured for military use. Type I refers to fresh oysters and Type II are frozen oysters.

Fresh oysters are sized according to count per gallon or quart, whereas frozen oysters are sized by count per 6 pounds. The military normally procures only frozen oysters.

5. Defective Oysters.

In most cases defective oysters will be identified prior to the actual processing of the product. A defect easily seen is termed "gaper" and is defined as an oyster having died prior to shucking, exhibiting an open shell and relaxed adductor muscle. Gaper oysters are not acceptable for military procurement.

Another condition often noted is termed green gilled oysters. This condition results from the ingestion of certain diatoms by the oyster and will appear as a bluish or brownish color in the pigment of the oyster's gills and mantle. Green gilled oysters are not acceptable for military procurement.

A condition found in frozen oysters is termed pink oyster. This is the result of the oyster meat coming into contact with a yeast. Normally the contact comes during processing; therefore, care must be taken to maintain superior sanitation and prevent contamination. Pink oysters should not be accepted; although there is one type of pink oyster acceptable. This condition results because of certain food being fed to the oyster by the growers. If this does exist, the producer must present a certificate certifying the oysters are not contaminated and the pink color is a result of controlled feeding.

In addition to oyster defects, origin and destination inspectors should be alert for damaged oysters.

6. Inspection of Oysters.

The military veterinary inspector may become involved in the inspection of oysters in three areas: origin, destination, and in-storage. Always insure that the military receives what it is paying for, and the oysters are handled and stored in the most beneficial manner. The source of the oyster is most important to the inspector, and as stated earlier, oysters can live in polluted waters and may become contaminated by human sewage. Communicable diseases such as typhoid and hepatitis are often associated with oysters; therefore, always insure the oysters being inspected have been harvested from a U.S. Public Health Service approved area. Samples of the oysters should be examined by an approved laboratory for the presence of coliform and other enteric organisms.

The origin inspector will also need to certify that the government is not buying shellfish affected by paralytic shellfish poisoning. This condition, in shellfish, may cause a severe poisoning of humans. This problem is most commonly found in clams, and does not cause harm to the shellfish. Shellfish feed on certain gonyaulax plankton which are plentiful during the summer months often causing "red tide." The toxin is accumulated in the digestive gland of shellfish.

Another important area is the amount of free liquor found in the containers of oysters. This liquor is a combination of the natural juices of the oyster and any water absorbed during processing by the oyster. At origin fresh oysters can have NMT 5% free liquor by weight, while at destination, the requirement is NMT 10%. This allows for more drainage of liquid from the oyster during transit. However, frozen oysters are not permitted this draining, and the requirement for free liquor is 5% for both origin and destination. This is an important factor to eliminate paying oyster prices for water.

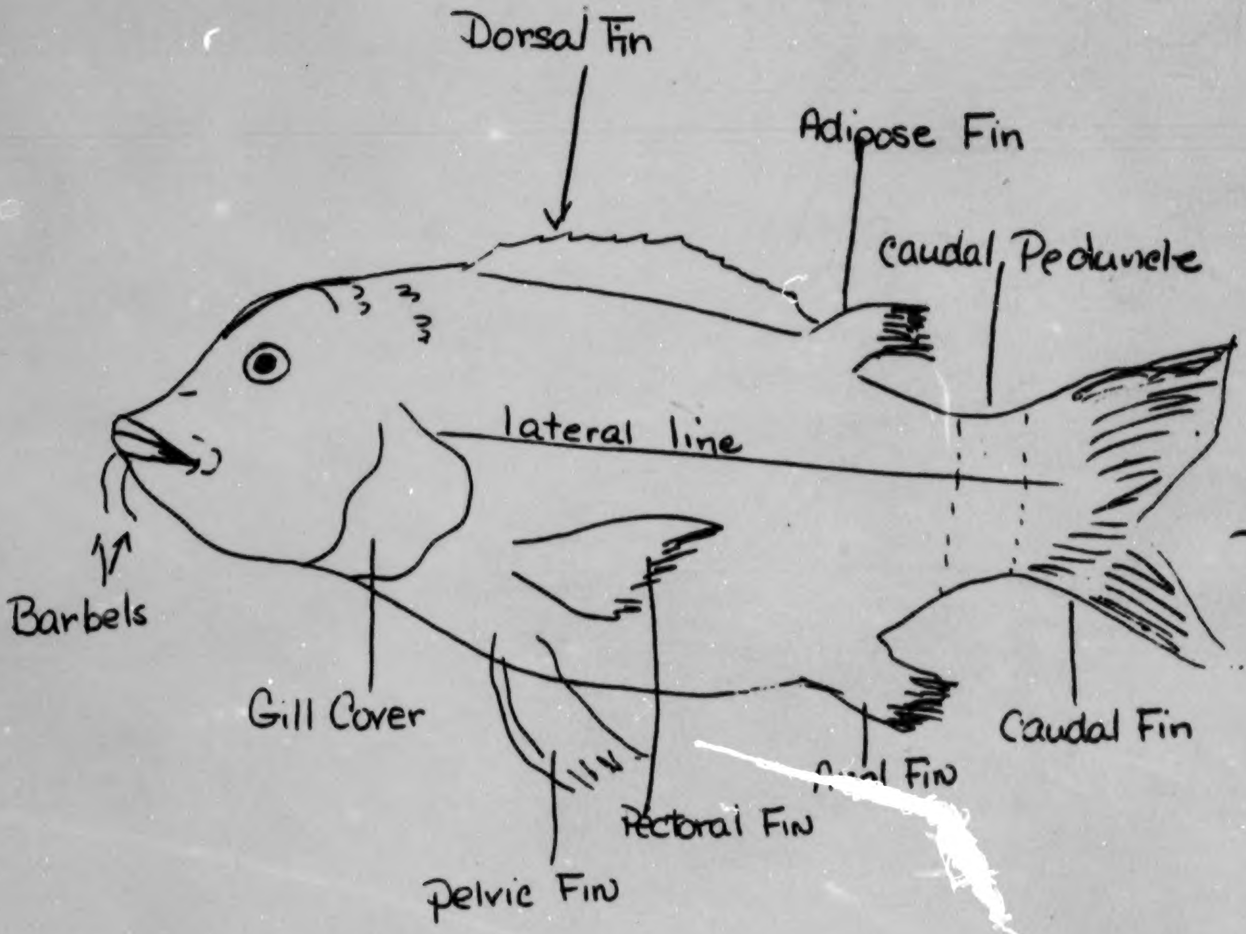
Oyster liquor is also examined to determine the palatability of the product. As the product ages, the liquor ferments resulting in a lower pH value indicating a more acid product. At origin, the pH value of a fresh oyster is to be NLT 6.2, while at destination, this value may drop to NLT 6.0. For in-storage inspection, we need to know that a reading of 5.9 indicates a stale oyster while 5.7 is considered a sour oyster. The palatability of a stale oyster is questionable and consideration should be given to the monetary value of the product. Sour oysters should not be utilized.

There are several ways to determine the pH of a product, but the Taylor Color Comparator is the one most commonly used in the inspection of oysters. Figure 6 shows a Taylor Color Comparator. The chemical, Chlorphenol red, is added to the liquor resulting in a color change of the liquor. This new liquor color is compared to "set" standards on the color comparator slide, thus allowing a pH determination of the product. Caution should always be practiced to not contaminate the solution.

With the knowledge gained from this section, the inspector should be familiar with the anatomy and processing of oysters. This knowledge will aid at destination as well as origin and insure the best product available.

SUMMARY:

The term "waterfoods" includes fish and shellfish. Proper handling of waterfoods, the changes they undergo from the time of harvest until they are consumed must be understood. The veterinary inspector must know the various methods used to retard deterioration and preserve quality, flavor, palatability, and desirability. The inspector also should become acquainted with the nature and extent of inspections performed by other government agencies, thus minimizing duplication of inspections. Military inspection is, in reality, a supplement to fill any unguarded gaps from the time the waterfoods are caught until they are accepted and consumed.


Dorsal Fin
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Anal Fin
Pectoral Fin
Pelvic Fin

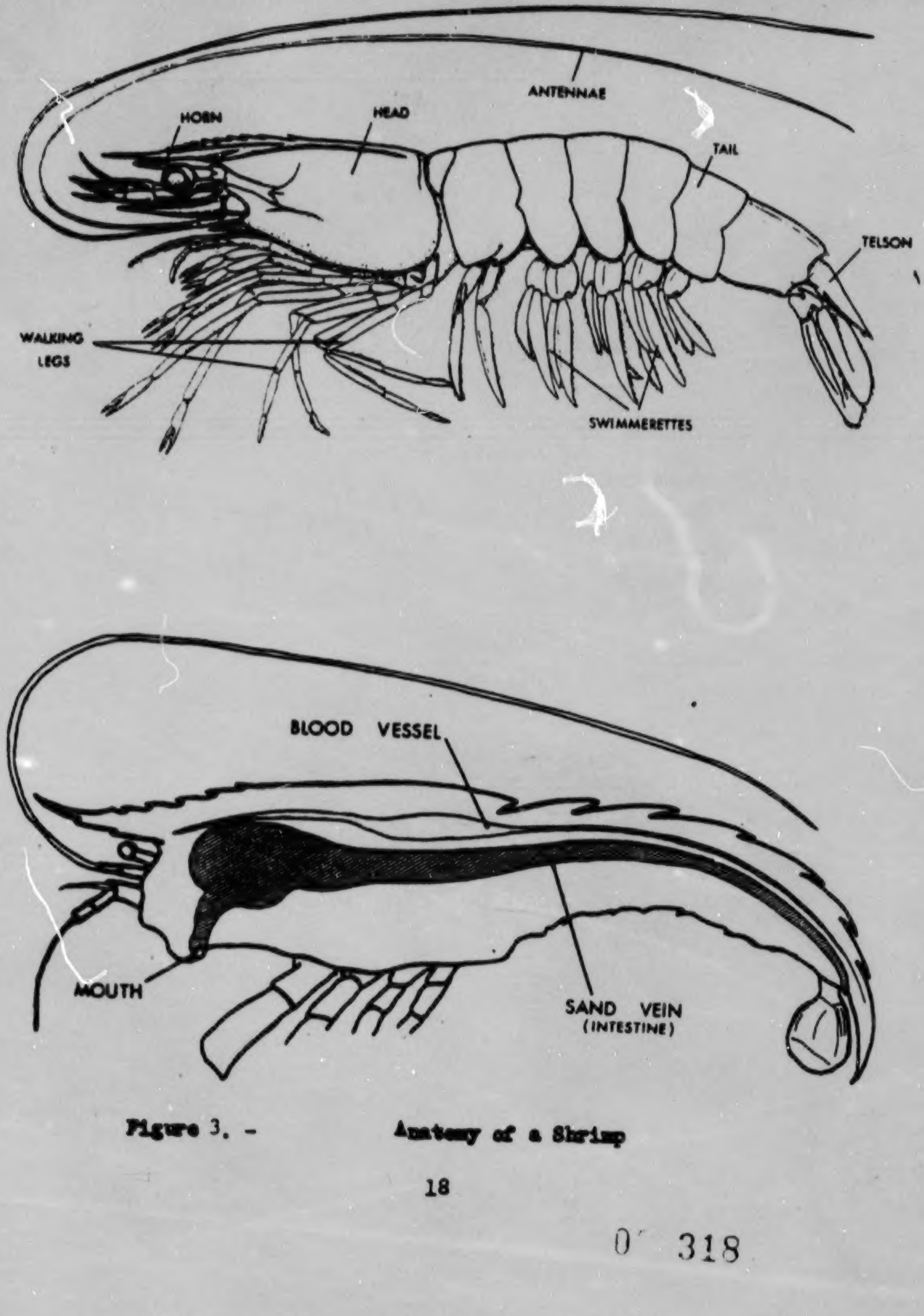

Figure 3. - Anatomy of a Shrimp

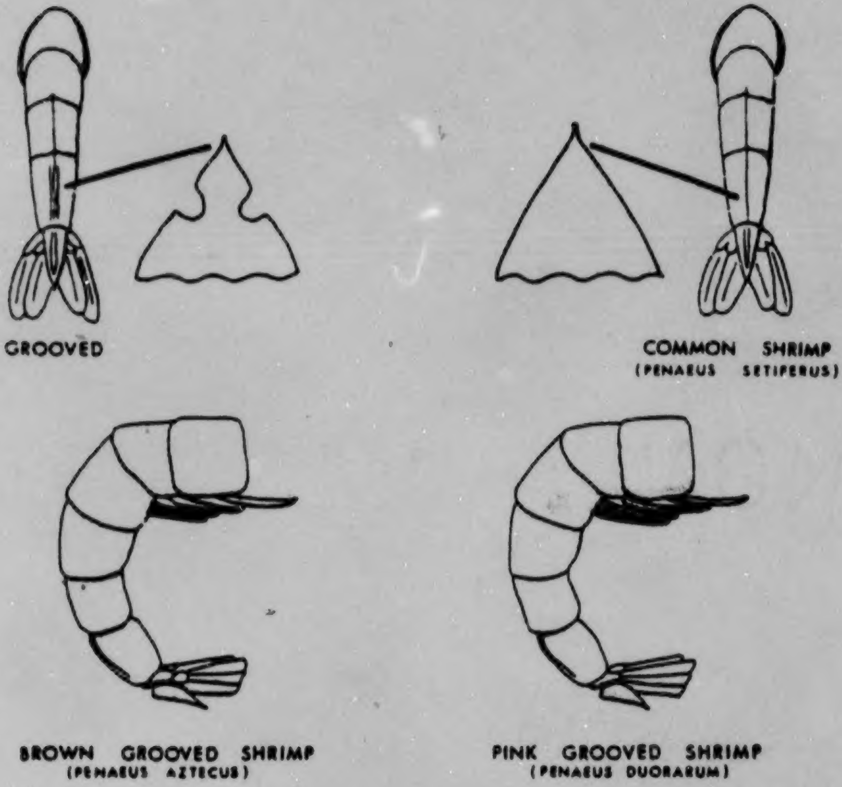

Figure 4. External Features of Common and Grooved Shrimp

STUDENT TEXT 3ABR90830-IX-2, 3OBR9921-1-II-7

DEPARTMENT OF VETERINARY MEDICINE

VETERINARY SPECIALIST
VETERINARIAN

FRUIT AND VEGETABLE INSPECTION

December 1974

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SCHOOL OF HEALTH CARE SCIENCES, USAF
SHEPPARD AIR FORCE BASE, TEXAS

Designed For ATC Course Use

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Department of Veterinary Medicine
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ST 3ABR90830-IX-2
30BR9921-1-II-7
December 1974

FRUIT AND VEGETABLE INSPECTION

OBJECTIVE

The objective of this text is to provide the student with basic information needed to understand factors involved in the inspection of fresh fruits and vegetables and in their storage.

INTRODUCTION

Fresh fruits and vegetables are still living items. This must be considered when we evaluate them for possible procurement and again when we are determining how they should be stored or how long they may be stored. In order to understand the effect which this may have, you first need a knowledge of plant anatomy and physiology. This text will provide you with basic information in this area. It will also include the basic details relative to grading of fresh fruits and vegetables.

INFORMATION

Approximately one dollar out of every 16 of the Armed Forces food budget is spent for fresh fruits and vegetables. Yet, nutritionally speaking, the product is a bargain - an investment in good health, not a luxury! Why? Because fruits and vegetables supply these percentages of the nutritional requirements of the Armed Forces each day: protein, 13 percent; carbohydrates, 15 percent; minerals, 52 percent; Vitamin A, 58 percent; Vitamin B, 48 percent; and Vitamin C, 92 percent. The quality, freshness, and handling technique of these products directly affect the available percentages of the above elements when the product gets to the table. That makes the know-how that you carry into the execution of your job an important investment. So in terms of nutrition, is the contractor delivering what is ordered? Is storage and handling such that the more valuable components do not shrink after purchase - is the dollar-value paid for actually placed on the table? Mark Twain quipped,"...A cauliflower is nothing but a cabbage with a college education." Could it be possible that a little more education could squeeze a little more value from the nutritional fruit and vegetable dollar?

Look at that aspect of your job which concerns fruits and vegetables. As a veterinary inspector you have three main tasks. First, you inspect fruits and vegetables to determine contract compliance. Second, you conduct surveillance inspection of fresh fruits and vegetables. During these inspections, your attention will often be focused on how fruits and vegetables are being handled at your base, which brings up your third assigned task; namely, to recommend proper practices and procedures for handling perishable fruits and vegetables.

Supersedes SG 3ABR90830-VI-2, September 1973

SECTION A - FACTORS INFLUENCING INSPECTION

1. Physiological Processes of Plants. Before discussing inspection, let us rapidly review the physiological processes and the related factors that have an effect on the inspection of fruits and vegetables.

a. Photosynthesis. Photosynthesis is nature's way of manufacturing chemical compounds within the plant with the aid of sunshine. The organic substance (chlorophyll) in the green part of the plant, under the urging of the sunshine's energy, combines water (as absorbed by the roots) and carbon dioxide (from the air) to produce a simple sugar and to liberate a waste product (free oxygen). This simple sugar is used to synthesize carbohydrates, fats, and proteins. After entry into the cell sap, the circulatory system of the plant transports the excess simple sugars, etc., to their plant storage position. Examples are: tubers, potato; stems, celery; and leaves, spinach.

b. Transpiration. The excess water absorbed by the roots is excreted by pores in the green leaf and evaporates (transpiration). The minerals in the water are retained for protein synthesis.

b. Respiration. Respiration is the liberation of stored energy to maintain the life processes of the plant. For instance, the living cells require oxygen support until the cell is destroyed by injury or disease. This respiratory process continues after the fruit or vegetable is harvested. As it continues, heat is released and carbon dioxide and water are formed as waste products. Type of plant and temperatures vary the amount, but poor ventilation will cause a rapid breakdown of the product as the by-products of respiration rapidly accumulate. The life span of a vegetable or fruit is dependent upon its respiratory rate. Since temperature controls the rate of respiration, proper temperature (35° F. to 38° F.) prolongs product life by slowing down the rate of respiration.

2. Causative Agents of Disease. Fresh fruits and vegetables, even after harvest, are still living plants. For inspection purposes, consider a plant disease to be any upset of the physiological processes within the vegetable or fruit - an upset which breaks down the product. Since fresh fruits and vegetable products are disease prone, consider the etiological agents (causes) of plant diseases as being either biological or physical. Biological causative agents include insects, bacteria, viruses, and molds. Physical agents can be subdivided into temperature, humidity, chemical, and mechanical groups.

a. Heating injury (sunburn or scald) primarily affects apples, peppers, and tomatoes. Examples are bronze apples and greenish potatoes where a scarcity of leaves allows too much sun to penetrate the plant. Another heating injury is caused by high temperatures during the washing process; for example, oranges so washed develop burnt and dried-out skins. On the other hand, in a low temperature injury (chill or freeze damage) - ice crystals form, crush cells, and cause a loss of juice. Rapid deterioration follows, creating a fertile field for infection.

b. The main agent, however, is bruising (crate pinching and rough handling). Cells are mechanically crushed, destroying their structure; and the skin may be broken, destroying the product's barrier to disease or to chemical damage. Thus, rough handling and bruising are precursory to most of the microbial-caused diseases. Later we will discuss more fully how injury serves as a point of entry for decay organisms.

c. Chemicals improperly used in plant processing often become causative agents. An example would be chemicals used to wash or to remove spray residuals. Specific examples are: (a) hydrochloric acid injury (appearing as a light tan burn on the product skin); (b) sodium silicate injury (appearing as a brown area on product skin); and (c) sulfur dioxide injury (appearing as gray blemishes on the product if excessively used for fumigation purposes).

d. Now let us illustrate how causative agents may occur in combinations. Consider penicillium rot (blue mold), a common disease that affects apples. The cells beneath the skin carry on their natural processes, even though the blue mold spore contaminates the skin. This spore is carried by the air. Under ideal conditions (temperature 50° F. to 60° F., high humidity) the spore will germinate and grow within 4 to 5 hours and spread across the apple skin surface, but it causes little or no damage to the fresh apple itself. (The spore may live for 2 weeks or longer under the above favorable conditions.)

(1) Since food and moisture are available, if a break occurs in the skin (introducing the mechanical agent into the combination) the disease is implanted almost immediately. Under less favorable conditions, such as lower temperatures, a longer time would have been required before the disease was established. As the disease progresses, cells die and disintegrate, and thereby release cell fluids. These cell fluids have no other place to go, so they flood the spaces between adjacent cells. Thus a water-soaked appearance gives evidence to the ravages of rot. This water-soaked appearance requires 4 to 7 days to develop. A later development of the disease results in the drying out of the diseased tissues, which, in turn, take on a brown appearance. In even more advanced stages, the external mold can actually be seen with the naked eye.

(2) There are many other fruit and vegetable diseases, most of which originate in a combination of causes. The signs may vary, but rough handling and bruising are too often the triggering agent. The upset physiological patterns observed are often similar to that described for blue mold. The water-soaked appearance is usually the first sign noted. The structural and physical change (pathological) varies as to temperature, humidity, and the causative agents.

3. Qualtiy Control of Perishable Produce. Temperature and heat control, both within the plant at the time of maturity, and on through the processing, inspection, handling, and storage of the harvested product, is another aspect of the harvested plant's life that we will review prior to our discussion of inspection. Maturity and ripeness, controlled humidity, cooling, and refrigeration all relate to quality control of perishable produce. Let's start by recalling the difference between maturity and ripeness.

a. Maturity vs. ripeness. Maturity is defined as that point where growth ceases: the seeds are developed and the item is at the stage of development where the ripening process will ensue. But this definition is relative. Actually, maturity is the growth development of the individual product. Different fruits and vegetables will have different maturity requirements that relate to their use and acceptability. For practical use, the term "maturity" must take into consideration where the product is to be consumed in relation to its origin. For example, tomatoes and pears must be picked in a mature green state if they are to be consumed any great distance away.

b. Ripeness is defined as that stage of development where enough of the starches have been converted into sugar to make the product fit for use. The flesh ordinarily yields to moderate pressure and the product is in prime eating condition.

c. Controlling heat. The enzymes contained by the living, breathing organisms bring about changes in color, texture, and chemical composition after harvest and throughout storage. These changes generate internal heat which hastens ripening and ultimate deterioration. Artificial methods are used to remove these heats or to control them if the produce is expected to maintain top quality. In your job you must be aware of the controls of three types of heat as they affect shipping, storage, and distribution of fruits and vegetables - field heat, vital heat, and container heat.

(1) Field (harvest) heat is that externally generated heat whose fast removal will favorably set color, flavor and texture, and retard enzymatic action. Preferably it is removed as soon as possible after harvest, sometimes during field packing. It may be removed by hydrocooling (ice and water) in the packing shed, or by vacuum cooling in the shed, car or crate.

(2) Vital (latent) heat is produced by respiration and other chemical changes during transportation and storage. Experts use this heat to determine relative temperature and humidity requirements for different species, as related in AFM 145-1, Commissary and Subsistence Depot Operating Manual. For instance, peaches, lettuce, and peas generate more vital heat since they have higher respiratory rates, while potatoes, onions, and apples generate less vital heat because of lower respiratory rates.

(3) Container heat is that acquired from the actual container material, from the interior surfaces of the warehouses and transporters, and from the surrounding atmosphere. This ambient temperature must be carefully controlled in refrigeration and storage handling.

d. Heat control vs. respiration control. Before proceeding into a more detailed explanation of heat control by refrigeration, let us examine the relationship of heat control to plant respiration. As previously stated, respiration is a continuous process. It takes place during photosynthesis and continues in the plants after harves. But control over the rate of respiration must be considered in the handling of all fruits and vegetables. Respiration must be accelerated for some products and decreased for others. Heat control is involved in both types of respiration. Respiration may be accelerated by exposing fruits and vegetables to high temperatures or by harvesting them in an advanced stage of maturity. The rate of respiration approximately doubles with each 18° F. increase in temperature. Ways of decreasing the rate of respiration include refrigeration, waxing, wrapping, and harvesting at a less advanced stage of maturity.

e. Refrigeration. Plants carry on a life process of respiration just as animals do. This process often must be slowed in storage if we are to prevent loss in quality. This slowing down of respiration is a function of heat control accomplished normally through refrigeration by reduction of temperature and by control of humidity.

(1) The most important factor in the refrigeration of fruits and vegetables is the proper control of temperature. There are certain basic generalizations but each fruit and vegetable must be individually controlled, and you can well be expected to recognize the results of malpractices.

(2) At freezing temperatures, certain fruits and vegetables are seriously injured. Yet lowering the temperature retards the growth of fungi and bacteria, and slows down respiratory and ripening processes. Conversely, at high temperatures respiration and chemical activity are accelerated and harmful molds and bacteria grow. For instance, the utilization of sugar almost doubles for every increase of 18° F. A typical vegetable will retain essential sweetness for only 1 day while stored at 80° F., but will retain essential sweetness for 14 days while stored at 40° F.

(3) Most of the basic generalizations center around temperature changes and their effects on humidity. A basic premise is that storage temperatures should not fluctuate. Why will be discussed later. A fall to 2° or 3° below freezing may injure plant tissue and make the product unfit to eat. For instance, incompletely ripened tomatoes, even though mature, will develop a water soft rot rather than ripen if not stored at proper temperatures. Here are some other objectionable outcomes of improper heat control.

(4) Potatoes stored for a few weeks at temperatures below 40° F. may develop a sweet taste because of the enzymatic action which converts the starch to sugar. Fried potatoes and potato chips made from such potatoes often develop a dark brown color. Cucumbers usually develop pits and dark, watery areas if held 10 days or longer at 45° F. Summer squash develop severe pitting in about 8 days if stored at 32° F. to 45° F. Under similar conditions, unripe melons undergo definite damage. Honeydew melons and cantaloupes, eggplant, and sweet peppers all may show chilling injury. Some of the subtropical fruits (such as pineapples, bananas, avocados, olives, etc.) are also susceptible to chilling injury. Grapefruit and lemons may develop abnormal skin or flesh if stored for several weeks at temperatures below 50° F.

f. Humidity control. Another factor closely connected with heat is humidity. Heat control and humidity control are closely related in your work. Humidity itself is a general term descriptive of wetness, or moisture content of the air.

(1) Relative humidity is the ratio of water vapor actually present in air compared to the greatest amount of water vapor possible in the same air at the same temperature. It is expressed as a percentage. Thus, a relative humidity (RH) of 100 percent expresses an atmosphere that is completely saturated. (See fig 1.) If the temperature drops, some moisture must precipitate out of the air. If the temperature rises, the capability of the atmosphere to hold water increases, and until such time as more water (through evaporation or plant respiration) is added to the air, the atmosphere's relative humidity decreases. (See fig 1.) (The same quantity of water divided by a larger capacity must equal a smaller percentage.)

(2) Each degree of temperature change will affect the relative humidity, as it will change the capability of the air to hold more or less water at the new temperature. But rising temperature also increases air absorption of water. A rising temperature increases both the rate of evaporation and the capacity of the air to hold water. As the temperature rises, more water evaporates from the plant. This evaporation (or drying out) affects the quality of fruits and vegetables during storage. It may cause a loss in weight or a decline in the texture, as evidenced by shrinkage or wrinkling. The rate of evaporation is affected by the relative humidity of the atmosphere in the storage room. On the other hand, if a saturated atmosphere cools, condensation occurs, and the water, once lost, is not reabsorbed by the plant, but collects and establishes a breeding place for unwanted growth of mold and bacteria. Now that explains in more detail the undesirability of fluctuating storage temperatures.

(3) There is no optimum relative humidity that is satisfactory for the storage of all fresh fruits and vegetables. Generally, leafy green vegetables require a high RH (90 or 95 percent). Onions, bananas, melons, and dquash need a lower (70 to 80 percent) RH. Remaining fruits and vegetables store well at 80 to 90 percent relative humidity. A good rule of thumb is to maintain humidity equal to or slightly above the normal moisture content of the product. A refrigerated room that is full of produce will usually maintain humidity at a satisfactory level. An almost empty room needs an additional source of moisture to overcome evaporation caused by refrigeration. Wet ice and water spray are methods that help. Since any solid object, to a degree, will collect or discharge moisture when sudden changes in temperature occur, ventilation will keep this moisture in the air and off the product - a very necessary requirement.

g. Storage guide. Refer to AFM 145-1 for recommended humidity and temperature requirements for fruits and vegetables.

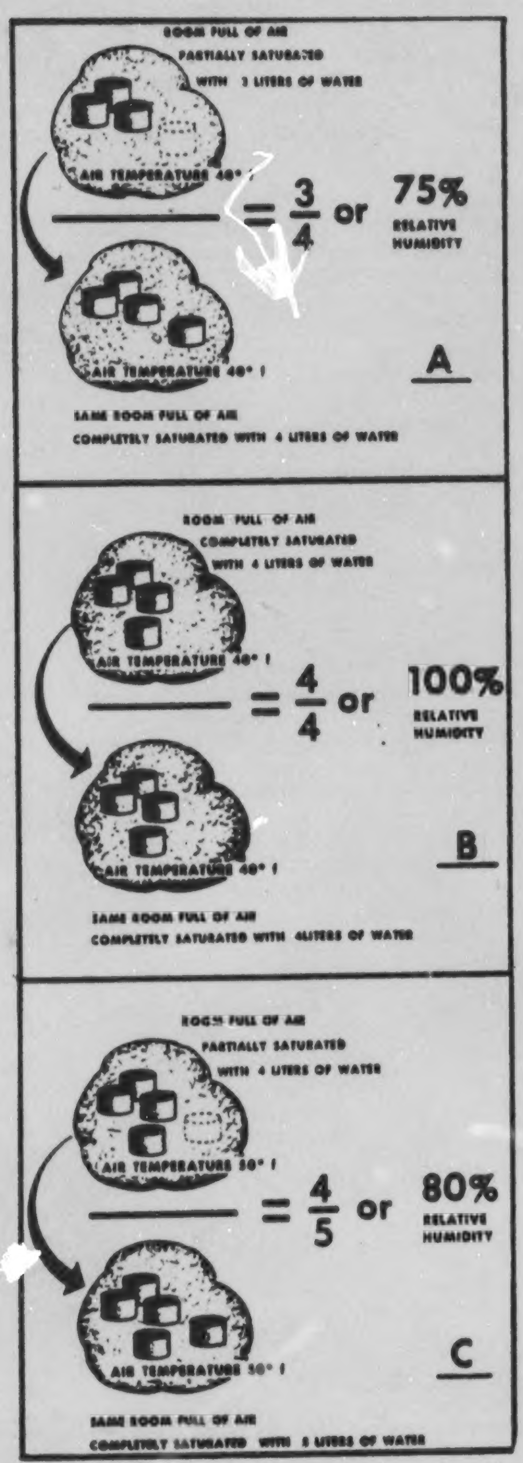

Figure 1. Effects of Water on Relative Humidity

SECTION B - HOW THE PRODUCT IS BOUGHT AND GRADED

1. General Instructions. A veterinary specialist (fresh fruit and vegetable inspector) is the middleman between buyer and user. Inspections start even before the product is bought. But there are certain general instructions concerning buying and writing a contract which have an indirect effect on your inspection. The following general instructions concerning buying were condensed from a chapter on fresh fruits and vegetables in the Defense Personnel Support Center Subsistence Inspection Manual.

a. Mandatory specifications. Specifications (for buying) are mandatory in the order listed: Federal Specifications, Coordinated Military Specifications approved by the Department of Defense, and U.S. Standards for Grades. However, a purchase description is used in lieu of a specification (spec.) where no applicable Federal or military spec. exists. The contract and related documents state specifically the grade, type, size, (and other optional factors) if specifications cover several grades or types, and provide for several options as to inspection, sizes, etc. While a brand or trade name is used for identification purposes, it must not appear as part of the specifications on the contract Terminology that is standard with industry (as defined in the U.S. Standards for Grades) is used as descriptive terms concerning the classification of damage, solidity, maturity, shape, cleanliness, etc. Nevertheless, specifications are not all that we consider before we buy. Exorbitant costs, unsatisfactory quality, or local unavailability may make supply of such specification type fresh fruits and vegetables impractical. But items below standardized grade or size will not be purchased without specific authorization from the requisitioning activity.

b. The only time that quality, condition, size, and other qualifying factors (as incorporated in the applicable grade specs.) are repeated on the contract is when they are higher or so unique as to merit full description. For example: POTATOES, white, fresh. Fed. Spec. HHH-P-622c, 18 January 1966 - No. 1, Size A, 2 inch minimum 16 ounce maximum, fairly clean or clean, practically no skinning, Colo. Red McClures, 100 lb. net....

c. DPSC clauses govern containers, packing, packaging, and marking - even if they are in conflict with Federal specifications. The standard practices of the procurement area and availability govern pack, type of container, and unit net weight unless otherwise requested by the requisitioning activity.

d. Delivery List. A Delivery List (DPSC Form 33-R or 33-1R or a copy of the Delivery List/Summary) is completed promptly after procurement. This list is for use by personnel responsible for inspection and acceptance of produce at destination (sometimes veterinary specialists). It includes (but is not limited to) the following: Name and address of contractor; contract number or office identification number; consignee; delivery schedule; product and quality; unit, unit net weight; unit price of nonlisted items; complete specs. with modifications including size, variety or type, and origin; distinguishing or identification marks and other factors, if they are required.

2. Methods of Procurement. There are three methods of procurement; street buying, field buying, and Notice of Intent to Purchase (NIP) buying. The first two will be contrasted, and the least desirable (NIP) buying will then be discussed.

a. Contrast of street and field buying. Street and field buying are alike in that both use a visual selection procedure in which the buyer makes visual comparisons between competitive suppliers and his award goes to that product of the best value to the Government as to price, quality, condition, and other factors. But in street buying, the procurement agent visits a terminal or local market, as contrasted with field buying where he visits growing areas or packing facilities to inspect and observe the products being harvested or packed. In both methods the procurement agent contracts as many qualified suppliers as is practicable so as to assure full and free competition. In both methods the buyers carry small looseleaf notebooks and record all offerings on DPSC Form 1-R.

b. These are the criteria for purchase: (a) samples selected at random; (b) assurance supplier has sufficient quantity of product on hand to meet specific requirements; (c) complete buyer-seller understanding as to terms and conditions of contract - placing special emphasis on price, grade, condition, maturity, size, and other qualifying factors; (d) designation of an acceptance point where supplies will be inspected for compliance and acceptance; and (e) agreement that in the event all or part of the supplies delivered are not in accordance with award agreement, they will be subject to rejection. The precautions are also taken to assure that products delivered are those actually selected: (a) buyers annotate DPSC Form 1-R with brand, trade name, or other distinguishing marks; (b) buyer identifies a representative number of containers by stamping, with a rubber stamp, region, purchase date, and other data; (c) buyer follows through to greatest possible degree.

c. Notice of Intent to Purchase (NIP) buying. NIP buying is kept to a minimum, and in no instance is it considered proper to use NIP buying concurrently with street or field buying for the same item. Solicitation for procurement of fresh fruits and vegetables is made to interested qualified suppliers by the publication of a Notice of Intent to Purchase (NIP) if time permits, or in emergencies by telephone or telegraph message. The NIP lists items to be purchased, quantities, specifications, delivery dates, closing time, applicable clauses, or other essential information. Interested suppliers submit their offers by mail, TWX, or verbally in person or by telephone. All offers are entered directly on Summary of Offerings, Fruits and Vegetables (DPSC Form 10, 10-1, or on DPSC EAM/ADPE Form 2011). Subsequent award is based on the lowest price. The successful supplier must furnish a USDA certificate of inspection to substantiate contract compliance inspection.

d. Since we are looking at buying from the inspection angle, let's examine in more detail some malpractices connected with buying based on the lowest responsive price, particularly as it relates to local purchase of fresh fruits and vegetables for resale. We quote excerpts from a Controlled Multiple Address Letter (CMAL). Air Force Logistics Command, based upon changes to be made in AFM 145-1.

> Current practice at a majority of installations is to local purchase fresh produce for resale on a low bid basis. The quality of produce purchased in this manner is responsible for many customer complaints . . . and often results in receipt of produce less than the best quality available in the area . . . Condition and abundance of produce are major factors in determining price. Items in good condition with maximum shelf life normally command a higher price. Deteriorated items are sold at prices in direct relation to their degree of deterioration.

e. Here are condensations and other excerpts that you, an inspector, may need to know:

> . . . In order to preclude losing money (because of a low bid made in a rising market) contractors may endeavor to substitute lower quality merchandise . . . (such as) old products repacked. Contractors may resort to attempting deliveries at short weights which cannot be detected (unless you are really alert) without 100 percent weighing and a detailed . . . inspection. For example, a vendor may take several hampers of green beans, dump them, fluff them up and water them just before delivery and get credit for an additional hamper.

3. Certification of Contract Compliance. Purchased fresh fruits and vegetables are inspected and supported by a certification to indicate contract compliance. In special procurements where the value of the produce would not justify the expense of USDA inspection, agents may inspect to certify contract compliance. However, the contract must reflect the procurement agreement as to whether the inspection will be furnished at the request and expense of the contractor or of the Government. Each truckload or carload of these products purchased directly from the growing area is supported by a USDA compliance inspection certificate at the request and expense of the contractor. No lot certificate is acceptable unless the lot identity is maintained on the lot itself and properly referenced on its respective certificate. Less-than-carload lot (LCL) quantity purchases from

produce terminal markets are normally inspected at the Government's expense. But at the discretion of the procurement agent, he may require inspection at the expense of the contractor.

a. Destination inspection. Destination inspections of fresh fruits and vegetables for count and condition are performed promptly after arrival at the destination by or for the Government at its own expense.

b. Product unit abbreviations. The following abbreviations are standard in descriptions of produce unit, and you must be able to identify each:

Bag	BG	Each	EA
Bale	BE	Flat	FA
Basket	BS	Hamper	HA
Box	BX	Hundred	HD
Bushel	BU	Hundredweight	HW
Carton	CT	Jumbo	JBO
Case	CS	Lug	LU
Chest	CH	Paper sack	SA
Container	CO	Pint	PT
Crate	CR	Pound	LB
Dozen	DZ	Sack	SX
Drum	DR	Tub	TB

4. Samples of Preferred Specifications. Preferred specifications for fresh fruits and vegetables are published in the Defense Personnel Support Center Manual for Subsistence, Buyer's Guide, Vol II, Sec III, Chapter XII, Fresh Fruits and Vegetables, pages 14-18, which is revised as necessary. Extracts to illustrate examples can be found in figure 2 (at the end of this chapter).

SECTION C - INSPECTION PROCEDURES

1. USDA's Developmental Role. The fruit and vegetable market has need for uniformity in inspection procedures. Buyers and sellers, including government purchasers, even though separated by thousands of miles, need to know what each is talking about. Basically, grading and the initial inspection of fruits and vegetables have been a primary function of the U.S. Dept of Agriculture for many years. The USDA guidelines or requirements for each individual product were not accomplished overnight, but have been in a continuing process of development - one which is still changing.

2. Grade vs. Condition. The inspection of fresh fruits and vegetables is made around two separate factors, grade and condition. Grade factors are those that pertain to a more permanent state of perfection or to freedom from defects. They do not change in transit. Condition factors are those which pertain to defects of a progressive nature that are subject to change in transit. These are factors that determine grade; quality, variety, maturity, chemical analysis, and size. The quality of a product is determined by eye appeal or appearance, its taste or flavor, and its internal makeup or texture. Varieties vary from a few factors for one product to many for others. Each variety has different characteristics that help determine its grade. Maturity has already been explained as the growth development of the individual product. It is reflected in grade factors by requirements based on use and acceptability. Certain products must meet certain chemical makeup requirements before they can be harvested in many states. For instance, grapes grown in California must have a certain sugar content before they can be harvested. Size is an important factor in grading fruits and vegetables; nearly all products must meet a minimum or maximum size requirement for the various grades.

3. Grade Designation. Grades are generally designated by names, numbers, or a combination of both. U.S. Fancy (or Extra Fancy) is the top grade reserved for those products of high color and of practically no defects. Since little of a crop will be free enough of defects and injury to rate this grade, premium prices are paid for this grade. The basic trading grade in U.S. No. 1, in general the highest grade of good average quality that is practicably packed under commercial conditions. This grade is the one most generally purchased by the military. Approximately 50 percent of the crop, under normal growing conditions, will be of this grade. Between U.S. No. 1 and U.S. No. 2 is an intermediate grade for quality standards not high enough for U.S. No. 1 but above U.S. No. 2. This grade, U.S. Combination (U.S. Commercial), is often used to describe the pack of a crop that is below average quality due to abnormal growing conditions. Consequently, U.S. No. 2 grade ordinarily represents the quality of the lowest grade that is practicably packed under normal conditions. In addition, there are these miscellaneous grades applying only to some products: U.S. No. 3, citrus; U.S. Utility, apples; U.S. Hail Grade, apples and pears; U.S. No. 1 Bright, Bronze, or Russet - used for citrus; Combination U.S. Fancy and U.S. No. 1; U.S. Extra Fancy, used for apples; U.S. Extra No. 1, used for pears, peaches, potatoes, and celery. The one thing to remember about grading is that it is never, except in cases of specified local contracting, the responsibility of military veterinary specialists; but experience will teach you to be fairly accurate in recognizing grades as you inspect shipments of USDA graded products.

4. Overview of Inspection. Before going further into the subject of grading and inspection, let's get the big picture concerning some general policies and procedures. These are to be followed in the inspection of fresh fruit and vegetables that are used to supply all military departments. These policies might become a part of your responsibility. These inspections for all food are broken into classes 1 through 9 inclusive. Somewhere along the line, varying with the situation, you"plug into" the circuit. However, Class 1 and 2 inspections do not concern fresh fruits and vegetables. The remaining inspections which do are grouped as procurement inspections (Classes 3, 4, and 8) and surveillance inspections (Classes 5, 6, 7, and 9).

a. Procurement inspections. Regulations stipulate that "procurement inspections (Classes 3, 4, and8) consist of the examination and testing of contractor-owned fruits and vegetables to preclude the acceptance of produce which is not wholesome . . . or which is potentially dangerous to health." Procurement inspections alwo "protect the financial interest of the government and of nonappropriated fund activities by determining contractural compliance for quality factors (type, class, grade, etc.) specified by the procurement agency." A background on grading has already been given. In the CONUS (Continental United States) the military normally does no Class 3 (origin) inspection of fresh fruits and vegetables. Rather the USDA State-Federal grader will do the Class 3 inspection and render a USDA inspection certificate for products entering interstate commerce. Where required or permitted, if no grader is available, the grower, packer, or jobber (collectively, the vendor) will certify grade of products on a Class 3 self-inspection and render a Certificate of Conformance (COC). Either of the two certificates certifies that the product is equal to or better than the grade required by the purchase instrument.

(1) Prior to purchase. These prior to purchase inspections are to determine compliance with requirements for sanitation, wholesomeness, and quality. The inspections are made in facilities provided by commercial contractors. Where then could you be involved? "Under the following conditions this class of inspection will be performed by personnel of the military veterinary services:

- On request whenever produce is locally procured by any Air Force installation.

- On request of a central procurement agency (Defense Personnel Support Center or Air Force procurement activity).

- In exceptional cases where the Surgeon General of the Air Force determines that the wholesomeness of food can be determined adequately only during its preparation."

(2) On delivery at purchase (destination). However, your responsibility may increase sharply in the Class 4 procurement type of inspection. An "on delivery at purchase (destination) inspection, Class 4, is the final inspection prior to transfer of ownership from the contractor to the Government." It too determines compliance with requirements for sanitation, wholesomeness, and quality as stipulated in the contract or other purchase agreement. If the Class 3 inspection report indicates compliance with the contract terms at the time of shipment, the Class 4 inspection responsibility (unless otherwise specified in the contract) is confined to condition, identity, and net weight determination procedures. If no Class 3 inspection has been performed, the Class 4 inspector is responsible for determining, to the extent possible, that all contract terms have been fulfilled. Personnel of the military Veterminary Services are responsible for performing final acceptance inspection of all foods received for military use. The final recommendation for acceptance or rejection will be based upon the results of Class 4 veterinary food inspection.

(3) Purchase by nonappropriated fund activities. Class 8 fruit and vegetable inspections (the third and last type of procurement inspection) are inspections made on purchases by nonappropriated fund activities on fresh produce purchased by exchange activities, open messes, or military clubs. They are normally made at time of delivery, but when specified in the contract, may be made during production in facilities provided by commercial contractors. Final acceptance or rejection will be based on the inspection made upon transfer of ownership from the contractor to the nonappropriated fund activity (unless specified by contract). The inspection determines compliance with sanitation, wholesomeness, and the quality requirements stipulated in the contract.

b. Surveillance inspections. The bulk of veterinary specialist inspections concerning fresh fruits and vegetables are surveillance inspections. "Class 5, 6, 7, and 9 inspections determine if Government-owned fresh fruits and vegetables are wholesome and suitable for further storage, shipment, issue, sale, and consumption." You look for "evidence of actual or potential deterioration or spoilage by microorganisms (or their toxins), chemicals, mechanical damage, or other foreign matter. Any recommendation for condemning a fresh fruit or vegetable produce on a surveillance inspection should be for reasons of unsanitary or unsound products only." (Unsanitary means unclean enough to endanger health.)

(1) Any receipt except purchase. "A Class 5 inspection (any receipt except purchase) is made upon receipt of any Government-owned fresh fruits and vegetables. It includes an inspection of the transport conveyances, since it is performed to detect any damage or deterioration which occurred to perishable products enroute; to give receiving officers an appraisal of the condition of the product so they know what to expect about its keeping quality; to establish a requirement for suitable warehousing facilities; and to detect faulty handling or transportation and prevent similar losses in the future."

(2) Prior to shipment. "A Class 6 inspection (prior to shipment) of Government-owned fruits and vegetables determines if the product is sound and suitable for shipment. It may serve to evaluate damage that occurred while in commercial storage. The inspections include the conveyances and an observation of the storage of the produce at the time of loading."

(3) At issur or sale. "A Class 7 (at issue or sale) inspection of Government fresh fruits and vegetables is performed at the time of issue to troop messes, dining halls, and other Government facilities. It includes the inspection of such produce in the accounts of commissary sales stores after receipt and prior to sale. One hundred percent of all such produce is inspected at a Class 7 inspection to insure that no contaminated, decomposed, or unwholesome produce is issued or offered for sale."

(4) During storage. "A Class 9 (during storage) inspection is performed on fresh fruits and vegetables held in storage or reserved for any appreciable time to detect early signs of deterioration so that accountable officers can issue or otherwise dispose of the

produce before additional losses occur. It also serves to detect faulty temperatures and warehouse practices which lead to deterioration. Inspection at more frequent intervals than one month is warranted for conditions other than normal at storage location."

5. Applicable DPSC Special Commodity Clauses. You will also need the latest applicable Defense Personnel Support Center Special Commodity Clauses for fresh fruits and vegetables. You will need to understand who initiates certification, and how the certificate gets to you. Below are typical extracts or condensations concerning products supplied on this type of contract and its subsequent inspection by Consumer and Agricultural Marketing Service, USDA, or by Federal-State inspectors.

a. Origin inspection. "Each carlot or trucklot procured on one day from one contractor will be given preliminary inspection at time of shipment and will be paid for by the contractor. Inspection certificates will cite rail car numbers and/or truck or trailer license number."

b. (Summarization of excerpt). All field, street, or NIP purchases in less-than-carload lot (LCL) or less-than-truckload lot (LTL) quantities offered for delivery to supply point and/or transportation terminals (intraregional or interregional shipments) or for direct delivery to consuming installations or shipside will:

(1) If in an amount of less than $300, be inspected at origin by contractor who furnishes a Certificate of Conformance for all terms of the contract, citing the contractural requirements for which the certificate is furnished and giving a statement that USDA inspection is not required.

(2) In an amount of $300 or more, receive a USDA inspection at the request and expense of contractor. (End of summary.)

c. Destination inspection. "On products procured F.O.B. destination, on which a prior inspection accomplished by the USDA at contractor's expense is a contractural requirement, acceptance inspection for identity and condition will be performed at destination. If (this) inspection at destination is accomplished by the Fresh Products Standardization and Inspection Branch, Fruit and Vegetable Division, Consumer and Agricultural Marketing Service, USDA, the inspection results will be final. If . . . performed by an agency other than the USDA, the results will (also) be final unless contractor . . . requests . . . a Formal Review (reinspection) by the USDA . . . "Products on which . . . a Certificate of Conformance by the contractor is a contractural requirement will be subject to inspection at destination for all terms of the contract. The results of such destination inspection will be final unless the contractor specifically requires an inspection by the USDA."

d. How inspection certificates more. How does the inspection certificate move in regard to the shipment? "The official inspection certificate (USDA or Federal-State Inspection Certificate) when required (or an official copy) must be attached to the original copy of the invoice, on which the contractor will annotate the number of the attached official inspection certificate. In addition, one copy of the inspection certificate will accompany (be on) each carlot or trucklot of the shipment. On LCL or LTL shipments, one copy of the inspection certificate (if required) will accompany the shipment. In the event a shipment is received without a required certificate, it will be inspected at the request of the Government, but at contractor expense."

6. Five Steps of Performing Destination Inspection of Consumer-Owned Products. Now, how is a Class 4 Inspection (DPSC Contract) at destination performed? The first step in Class 4 Inspection (DPSC Contract) for either a carlot shipment or less than a carlot shipment is to examine the USDA origin inspection certificate or to check the vendor's Certificate of Conformance.

a. The second step is to open the truck or car and see if the products match those on the inspection certificate. If they do not or if there is no certificate presented, halt the inspection and immediately contact the veterinary NCOIC or OIC. He will in turn notify the Quality Assurance Office, Subsistence Regional Headquarters of the Defense Personnel Supply Center (QAO-SRH-DPSC) and ask for further instructions. They, in reply, will advise one of three actions: reject the load to the vendor, hold the load pending further investigation, or continue the inspection. In case the load conforms to the certificate, or QAO-SRH-DPSC has ordered the inspection continued, move to the next step.

b. In step three, select your sample. Determine lot size from vendor's invoice. Then select sample size for condition inspection - use MIL-STD-105D, "Single or multiple normal S-3 level. Draw samples from both sides of car, both ends of car, each layer of car, and around the door.

c. Step four is the actual examination for condition. Examine the representative sample for total damage, including rots, freezing injury, bruises, soft fruits, wilted or soft vegetables, the presence of live insects, or any defect listed in the specifications or U.S. Standards. Compute your percentages of defects allowable (tolerances) at destination. If defects are less than the maximum allowable, recommend acceptance; if more, recommend rejection or acceptance with a price adjustment, to QAO-SRH-DPSC (provided, of course, that step five examination is also satisfactory).

d. Step five is the examination of the product for net weight and, if more convenient for the inspector, can precede the listed step four (condition examination). Similarly, use MIL-STD-105D, but reference single normal S-4 level, and select sample size, this time for net weight examination. Reference para 3 of DPSC clause 200a for an explanation of container weight requirements. If these requirements are met, along with previously stated requirements, the product should be recommended for acceptance. If not met, advise QAO-SRH-DPSC, and recommend rejection, or acceptance with a price adjustment.

7. Government-Owned Destination Inspection. Class 5 inspection is that performed on Government-owned destination shipments, so you can surmise that a USDA inspection certificate or a vendor's Certificate of Conformance will not accompany the shipment. The shipment will otherwise be examined similarly to a Class 4 inspection unless DPSC Regional Headquarters specifies standard Class 5 operating procedures that differ. Remember that a Class 4 inspection has been performed on the product before you received it. However, if the products are unduly distressed and do not meet the minimum tolerance for defects, your only recourse is to use DPSC Form 2572-1 and report your findings to QAO-SRH-DPSC. The exception is in cases where the carrier has been at fault in causing defects, so the contract carrier can be held liable. The distressed products are rejected to him. An example would be a Class 5 shipment of fruits and vegetables which arrives at your base in an extremely distressed condition due to poor refrigeration of the conveyance. Another example would be where the contract carrier's conveyance was involved in an accident and a damaged portion of the load is rejected because the containers were broken open and the products bruised and mashed.

SECTION D - REFRIGERATION AND TRANSPORTATION PRACTICES

Frozen Fruits and Vegetables. Modern refrigeration and transportation practices have made possible the use of frozen fruits and vegetables all over the world. Frozen produce is common in every modern grocery store and commissary, and is consumed in armed forces dining halls every day. Certain physical and chemical changes which occur in a frozen product must be understood in order to interpret condition factors.

1. Changes Caused by Freezing

a. Physical Changes

(1) Freezing causes ice crystals to form in the air spaces between cells.

(a) A product that is frozen quickly will contain smaller ice crystals than one which is frozen slowly.

(b) More ice crystals are formed at a low temperature than are formed at a higher, though freezing, temperature.

(2) Ice crystals puncture cell walls. For example, strawberries consist of cells about 15 microns in diameter. The size of ice crystals formed by the contact plate method of freezing is approximately 200 x 800 microns. Many strawberry cells are destroyed by the sharp edges and pressure from ice crystals.

b. Chemical Changes

(1) Moisture from the cells is withdrawn to form and enlarge the ice crystals. More moisture is withdrawn during the freezing process than the cells reabsorb during thawing, resulting in a flabbiness of the product.

(2) The normal makeup of the individual cell contents is destroyed by the freezing process, resulting in loss of juices.

2. Changes that Occur in Storage. Accelerated growth of the ice crystals is caused by fluctuating temperatures. The chemical and enzymatic processes naturally occurring in produce are greatly retarded by freezing and take place slowly. Desiccation (loss of moisture) occurs, especially in vegetables, unless the product is frozen in brine or is protected by a moisture-vaporproof container. A higher storage temperature causes more drying out and increased chemical and enzymatic actions.

3. Changes that Occur Upon Thawing. Upon thawing, the changes that took place in a product while it was frozen are greatly accelerated. Most thawed fruits weep or leak badly and are easily penetrated by microorganisms. Vegetables deteriorate rapidly upon thawing and spoil within 24 hours at 70° F. Fruits are usually edible at the end of this time. There is a considerable leakage in nonstarchy vegetables, resulting in a loss of valuable nutrients, if this juice is discarded.

4. Defects in Frozen Produce

a. Dark brown or black color (oxidation)

b. Desiccation

c. Defrosting symptoms

(1) Wet boxes

(2) Wrinkled boxes

(3) Stained boxes

SECTION E - INSPECTION PROCEDURES IN OVERSEA AREAS

Inspection of Indigenous Fruits and Vegetables in Oversea Areas. Inspection procedures for indigenous fruits and vegetables are usually well established by the Air Force Command or Army Veterinarian at locations where U.S. military forces have been in place for some time. When armed forces are moved into combat areas, the logistic problems involved in providing military personnel with fresh fruits and vegetables are difficult. Under these circumstances, it may be necessary for veterinary personnel to survey areas to determine the soil and fertilizing policies and the sanitary controls that are maintained. An educational program should be established to complement field sanitation training. This educational program should include the hazard of consuming raw, unpeeled, or unchlorinated fruits and vegetables that are grown on soils fertilized by night soil (human feces) or on soils where fertilizing practices cannot be definitely determined. It is particularly important for veterinary personnel to advise clubs and messes that no fruits or vegetables are to be procured from nonapproved sources. If you take part in this work, conduct surveys, identify approved areas, and then publish a list of approved sources. As an added control measure, establish a system of identifying or certifying products to ensure that those which have been fertilized by night soil are not substituted for products that are grown in fields fertilized by chemicals.

1. Chemical Fertilizer. Products grown on fields where chemical fertilizers are used and where night soil has not been used for a few years are relatively safe. However, if products are grown by both methods, disinfection with chlorine and/or peeling is necessary.

2. Hydroponic Vegetables. In the Far East, vegetables are grown hydroponically - that is, they are grown in a mixture of water and chemicals. Vegetables produced in this way are quite satisfactory if they are handled under sanitary conditions. However, they are usually more watery than soil-grown vegetables and do not keep as long.

SAMPLE OF PREFERRED SPECIFICATIONS

COMMODITY DESIGNATION	NOMENCLATURE	UNIT	MINIMUM AVERAGE NET WEIGHT
9.52 LETTUCE, Iceberg or Big Boston Type FSN 8915-252-3789	Fed Spec HHH-L-226d, 22 Mar 63 & Amend 2, 4 Oct 65, U.S. No. 1 Grade, 2 doz, size, vacuum cooled	CT or CR	35 LBS
9.65 ORANGES, Florida FSN 8915-616-0212	Interim Fed Spec Y-O-663d, 25 Sep 67 and as amended, U.S. No. 1 Grade, 72-113 count, any variety except Temple (specify percent of size purchased)	CT or 1/2 CR	35 LBS
9.81 POTATOES, White Baking	Fed Spec HHH-P-622c, 18 Jan 66, U.S. No. 1 Grade, long baking type, 8 to 12 oz, fairly clean or clean and not more than slightly skinned	SX SA	100 LBS 50 LBS

Figure 2. Example of Preferred Specifications, Fresh Fruits and Vegetables

ATC-SHEPPARD AFB TEX. 75-96

Department of Veterinary Medicine
School of Health Care Sciences, USAF
Sheppard AFB, Texas

ST 3ABR90830-IX-1
3OBR9921-1-II-7a
July 1974

INSPECTION OF WATERFOODS

OBJECTIVE

Upon completion of this chapter on waterfoods, you will be able to inspect fish and shellfish for quality, wholesomeness and contract compliance.

INTRODUCTION

The term waterfoods includes fish and shellfish. The anatomical structure used in the identification and inspection will be discussed in this chapter. Because plant equipment and processing methods vary, only typical ones are discussed. You will become familiar with defects found in waterfood products and the biological changes that take place after death. You will be able to use this knowledge to determine freshness of various fish products. This chapter is divided into the following sections:

Section I - Fish
Section II - Crustaceans (Shrimp)
Section III - Mollusks (Oysters)

SECTION A - FISH

1. Anatomy of Fish.

Prior to inspecting any product, you should become familiar with the basic anatomy of that product. Figure 1 is a view of a fish and some of the points of reference are designated. Before, during, and after your inspection, you may be called upon to discuss some of these points of reference with the vendor, procurement personnel, or your fellow workers. "Was the caudal peduncle removed?" may be asked of you.

The first part of the anatomy to discuss is the fins. Fins are used by inspectors to identify a specie of fish and as a point of reference in processing. There are two types of fins, single and paired.

Single	Paired
Dorsal	Pelvic
Caudal	Pectoral
Anal	
Adipose	

This supersedes ST 3ABR90830-VI-1, March 1973

PURPOSE OF STUDY GUIDES, WORKBOOKS, PROGRAMMED TEXTS AND HANDOUTS

Study Guides, Workbooks, Programmed Texts and Handouts are training publications authorized by Air Training Command (ATC) for student use in ATC courses.

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The STUDY GUIDE AND WORKBOOK (SW) contains both SG and WB material under one cover. The two training publications are combined when the WB is not designed for you to write in, or when both SG and WB are issued for you to keep.

The PROGRAMMED TEXT (PT) presents information in planned steps with provisions for you to actively respond to each step. You are given immediate knowledge of the correctness of each response. PTs may either replace or augment SGs and WBs.

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STUDY GUIDE AND WORKBOOK 3ABR90830-IX-2

DEPARTMENT OF VETERINARY MEDICINE

VETERINARY SPECIALIST

FRUIT AND VEGETABLE INSPECTION

December 1974

1-4

SCHOOL OF HEALTH CARE SCIENCES, USAF
SHEPPARD AIR FORCE BASE, TEXAS

Designed For ATC Course Use

DO NOT USE ON THE JOB

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WORKBOOK 3ABR90830-IX-2
April 1975

Department of Veterinary Medicine
School of Health Care Sciences, USAF
Sheppard Air Force Base, Texas

FRUIT AND VEGETABLE INSPECTION

OBJECTIVE

With the aid of the audio-visual lesson, "Maintaining Garden Freshness of Fruits and Vegetables," each student will complete this workbook. Each student will be able to evaluate storage conditions that are provided, identify discrepancies, and make corrective recommendations.

PROCEDURES

The veterinary inspector should understand the importance of recognizing the conditions and varieties of fresh fruits and vegetables. As you know, 1/16 of our subsistence budget involves this food group.

Two very important questions should always be answered: (1) Does the product satisfy the purpose for which it was procured? (2) Is it wholesome?

After listening to the preceding programmed lesson, the student will respond to the following questions.

NOTE: To clarify any areas that might have been covered too rapidly, or if you are unable to completely answer the questions, rewind the tape and reset the carousel for a replay. This should allow you sufficient material to complete the exercise.

1-4

1. Two major problems that contribute to losses in produce are ______ ______ and ______.

2. The most important life process that occurs in fruits and vegetables is ______ ______.

3. Oxygen taken up in respiration combines with sugar and gives off ______ ______ and ______.

4. Development of abnormal odors and flavors in fruits and vegetables occurs when their environment is depleted of the element ______.

5. The most perishable products have the ______ respiration, while the least perishable have the ______ respiration.

6. The best way of slowing down respiration and other life processes is ______ ______.

7. When the vendor slows down the rate of living of fruits and vegetables, he is preserving maximum ______ and ______.

This supersedes SW 3ABR90830-VI-2-1, March 1973

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8. Diphenylamine, a chemical preservative, is introduced to apples to prevent a defect commonly called ______________________________.

9. Wilting or shriveling is caused by a loss of moisture. What can be done to minimize this loss?

____

____

____

10. Most fruits and vegetables are composed of ____ to ____ percent water.

11. Internal rot, resulting from bruises on perishable produce, will significantly decrease the shelf life. What process is increased?

____

12. Lettuce is vacuum cooled prior to shipping to drop the temperature down to ____° to ____° F.

13. Name two products hydrocooled to a temperature of 32° F.

______________________________ and ______________________________.

14. The USDA handbook, "The Commercial Storage of Fruits and Vegetables," contains three basic requirements for optimum storage. Name these requirements.

____

____

____

15. Explain the purpose of using controlled atmosphere for supplementing the refrigeration of fruits and vegetables.

____

____

____

____

16. Transparent polyethylene packaging material should be perforated. Why?

____

17. To prevent greening of potatoes, where should they be stored?

____

18. A large truckload of produce is received at your base. The primary responsibility of performing a veterinary inspection of these highly perishable subsistence items is delegated to you. Briefly discuss your "plan of inspection" and list those areas of importance that require your maximum concern and attentiveness.

19. Reflecting back to your previous training in food-borne illnesses, are fresh fruits and vegetables a good source of food-borne illness? Why?

20. Why are we concerned with the inspection of fresh fruits and vegetables that are government owned?

STUDENT TEXT

3ABR90830-X-1
3AZR90870-2-I-14
3OBR9921-1-III-3

Technical Training

Veterinary Specialist

FOOD TECHNOLOGY

1-4

December 1975

SCHOOL OF HEALTH CARE SCIENCES, USAF
Department of Veterinary Medicine
Sheppard Air Force Base, Texas 76311

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ST 3ABR90830-X-1
3AZR90870-2-I-14
30BR9921-1-III-3
December 1975

Chapter 4

FOOD TECHNOLOGY

OBJECTIVE

To achieve a working knowledge of food technology, you will complete this chapter in the basic principles of spoilage prevention in performing evaluations of contract compliance, as well as preventing contamination of food in storage.

INTRODUCTION

In our forthcoming discussion of this chapter on food technology, we will include many phases of the previous subjects covered in this course. The application of statistical sampling, microbiology and certain aspects of FES can be utilized in defining your responsibilities as food inspectors. Along with these practical applications, you will also be expected to examine preserved foods and know what process has been employed in protecting them. You also will determine the suitability of packaging used and exactly what storage practices need to be followed to assure their intended use.

This supersedes ST 3ABR90830-X-1, 3AZR90870-2-I-4, and 30BR9921-1-III-3, August 1974.

MILITARY MISSIONS hinge upon availability of wholesome food for troops. But much of the world's food is spoiled by microbes or is contaminated or destroyed by insects, rats, or other vermin. So food preservation and other aspects of food technology are of importance to you. Your responsibility can include such tasks as to: (1) use statistical methods to inspect food; (2) assist in the evaluation of contractor inspections; (3) perform verification inspections; (4) inspect preserved foods; (5) inspect military operational rations; and (6) inspect foods for proper packaging, packing, and marking. In this chapter, you will learn to relate food technology to the performance of the above-listed tasks. We will discuss:

. Purposes of food preservation.

. Steps in processing (unit operations), packaging, protection, and storage that are associated with the sun-drying, evaporation, dehydration, and freeze-dehydration of food.

. Methods of freezing foods; and the packing, storage, and thawing of frozen foods.

. Steps in processing (unit operations), packing, protection, and storage of both canned and irradiated foods.

. Process of preserving food by fermentation.

. The use of additives to preserve, extend the shelf-life, and improve the flavor of foods.

. Types of packaging and packing materials for foods.

. Practices, spoilage, and precautions related to both cold and dry storage of foods.

. Inspection of canned goods, and types of canned goods defects.

. Types of operational rations and their inspection.

We will begin the chapter with a discussion of the specific aims of food preservation.

1. PURPOSES OF FOOD PRESERVATION

1-1. The military services enjoy several advantages from using preserved foods. For instance, such seasonal foods as strawberries are made available at any season of the year, at any world-wide base of operations. Furthermore, surplus foods can be reserved for use in years of shortages, and properly preserved foods are moved to geographical areas where these supplies are either short or nonexistent. A member of the Armed Forces enjoys the luxury of having meats, fruits, and vegetables in his military freezing unit or in cans on the dining hall pantry shelves. To keep this situation going, your knowledge and actions must help do these three things: (1) prevent the spoilage of food, (2) preserve its nutrients, and (3) prevent its contamination.

1-2. Prevention of Spoilage. The primary aim of food preservation is to prevent food spoilage. But what is spoilage? In a sense, food is considered spoiled when microorganisms and/or enzymes break down the organic material of its structures and alter it to such an extent that discriminating people will not accept it for consumption. Yet foods considered as acceptable from a taste or esthetic standpoint may be harmful because of microbial, chemical, or radiological contamination, and this spoilage may not always be easily detected. Limburger cheese and aged beef are readily acceptable to some people, but violently rejected by others. So customs and eating habits influence food acceptability. In meeting our food inspection responsibilities, therefore, we must consider not only the aspect of acceptability as represented by the esthetic values of a food's appearance, taste, odor, and color, but we must also give even greater emphasis to the identification of spoilage or contamination which may cause illness. Let's look at six significant factors affecting or causing spoilage.

1-3. Food composition affects spoilage. Dry storage foods which, from a chemical standpoint, are physically inert (such as flour, sugar, cereals, and beans) usually do not spoil unless contaminated by vermin, water, radioactivity, poisons, or chemicals. Semiperishable foods containing water or volatile ingredients (such as potatoes, apples, and nuts) may remain unspoiled for relatively long periods provided they are properly stored. Because meats, milk, fish, poultry, fruits, vegetables and eggs contain bacteria and their associated enzymes in a semiliquid environment, they are considered perishable and hence must be either processed or refrigerated for storage. Spoilage will proceed more rapidly in any food having a relatively neutral pH or which contains a high percentage of water along with medium to low amounts of sugar or salt. The chemical structure of the food is yet another factor which may either accelerate or decelerate food spoilage depending upon the combinations and nature thereof.

1-4. Microorganisms Cause Spoilage. Microorganisms are an alien factor in food spoilage. The degree of spoilage and the rapidity with which they can cause it depend upon several environmental conditions, such as the temperature, oxygen availability, and humidity. The number of types of such microorganisms is large. In general, however, their species include bacteria, yeasts, and molds. Each of these species requires an environment in which it grows best. Then, when optimum conditions exist, spoilage occurs at a very rapid rate. Therefore, the purpose of food preservation is to make the environment unacceptable to the organisms which may be present.

1-5. In comparison with the breakdown of carbohydrates, bacterial decomposition of protein causes the most undesirable changes in food quality. Usually it is the protein breakdown that causes the stench which is associated with rotten food. Ordinarily, microbial breakdown of fat causes a cheesy or rancid odor, while that of carbohydrates produces a sour, gassy type of spoilage. The type of decomposition and its related odor results from the type of by-product liberated by the organisms as they feed on the food nutrients. In the case of proteins, bacteria convert them into various nitrogenous compounds having extremely obnoxious odors. As regards the fat, bacteria split off fatty acids which, depending upon those liberated, produce a variety of odors. In carbohydrate spoilage, bacteria convert these elements into both acids and carbon dioxide gas. In all of these instances, the decomposition reactions will be affected by moisture conditions, such environmental conditions as oxygen availability and amount of light, and by various chemical factors. Sometimes these later factors hasten decomposition and in other cases they retard it.

1-6. To elaborate somewhat upon the mitigating factors in food spoilage, we might begin with moisture conditions. For instance, bacteria must have their food in a soluble form. Hence, by controlling moisture conditions, we can control microbia growth. This may be done either by reducing the water content in the food product or by limiting its availability from outside sources. In the first solution, there are several choices as to the method to be used. Sugar or salt may be added, causing some of the contained water either to be withdrawn or to be tied up in the resulting solution and, therefore, unavailable to bacteria. The food may be frozen, thereby changing the water to a solid and, again, reducing its availability. In any case, we may limit bacterial action if we can keep the moisture content below 10 to 15 percent. However, this percentage varies widely, depending upon the particular food product, the amount of nutrients in solution, the interactions of integral chemicals, and environmental factors. Usually, though, if the water content is below 30 percent, disease-producing organisms will not readily grow. In general, yeasts require slightly less moisture than do bacteria, while molds require only a very small amount of moisture. Molds can grow on a quite dry product provided humidity is high.

1-7. Considering further the application of salt or sugar to food products in an effort to control bacterial activity, certain concentrations of either can control most if not all microbial growth. However, some bacteria are adaptable and may grow in saturated salt or sugar solutions. In general, gram-negative bacteria are inhibited by an 8-percent or stronger salt concentration, while a few gram-positive types will grow in saturated salt solutions. Most disease-producing or pathogenic bacteria will be inhibited by 15 percent or higher salt concentrations and by 25 percent or higher sugar solutions. Molds, on the other hand, are resistant to higher concentrations of sugar, since they do not require water in the food itself but, rather, can extract it from the air. In such cases, molds use only the carbohydrate or sugar in the food product.

1-8. Generally bacteria prefer foods in which the acidity is nearly neutral; yeasts can tolerate slightly acid foods; while molds can tolerate and grow in extremely acid foods. For example, milk, meat, and seafoods (pH 6.7 to 7.0, or nearly neutral) are likely to be spoiled by bacteria. Fruit juices and other acid foods (pH 3.5 to 4.5) containing fermentable carbohydrate are more subject to yeast spoilage, since the acidity helps to prevent bacteria growth. Rhubarb, cranberries, and similar highly acid foods (pH 2.6 to 3.2 very acid) are apt to be spoiled by molds, since this extremely acid pH will prevent growth of both yeast and most bacteria. Normally, pathogenic organisms will not grow in those foods with a pH lower than 4.5 In fact, these organisms will die off in foods with a pH below 4.5,

1-9. Temperature is an important environmental factor concerning spoilage by microorganisms. Relatively high environmental temperatures permit only the growth of thermophilic (said of bacteria which develop best at a temperature of 104°F. to 158°F. or 40°C. to 70°C.) organisms. Thermophilic bacteria can cause spoilage of milk held at such high temperatures, and of canned goods that are cooled too slowly after processing. Thermophilic yeasts and molds are so few as to present no special problem. Bad tastes and odors develop in milk from the activity of psychrophilic organisms (said of bacteria which develop best between 15°C. to 20°C. or 59°F. to 68°F.). Even at temperatures of 32°F. or slightly higher, mold organisms will grow in meats, eggs, cheese, fruits and vegetables. Bacteria tolerant to low temperature usually grow slowly. Yet, if adequate moisture is present, slime may form on meats, eggs may rot, and poultry, fish, and milk will spoil in a matter of days even when stored under refrigeration. So we can summarize by saying that storage temperatures affect the growth of microorganisms. In general, the higher the temperature (up to temperatures high enough to kill microorganisms) the greater the rate of growth. Foods so stored (or those chilled too slowly) may spoil in a few hours. In general, pathogens will not grow, though they may live, below 40°F. This fact can often be used to determine safety of foods as opposed to spoilage factors.

1-10. Enzymes Spoil Food. Bacteria produce enzymes which cause food spoilage; but generally when we speak of enzyme spoilage, we refer to the enzymes normally present in food, rather than to the enzymes which are produced as a by-product of bacterial spoilage. Enzymes, organic substances secreted by body cells, are capable of inducing chemical changes in the substrate while remaining unchanged themselves (a substrate is a substance acted upon). The enzymes, like bacteria, are affected by such environmental factors as temperature, pH, and chemicals, including salts. Certain carbohydrate foods contain amylase, an enzyme which can change starches to sugar (example, the enzymatic action which softens and sweetens sweet potatoes). Other enzymes found in living cells are called autolytic, which means that they act on the tissues of their food causing it to break down or spoil. Yet many of these can be controlled to perform useful functions, as in the case where the enzyme is used to tenderize beef in the process of producing what is called "aged beef." In the processing of dehydrated foods, moisture is removed to a level whereby microorganisms do not grow well, yet enzymes will usually continue to act on the fat and other ingredients unless the moisture content is well below 1 percent, and will thereby produce unwanted changes in the food. However, such undesirable enzyme activity can frequently be prevented by other means, such as blanching or heating the product slightly or by adding acids so as to lower pH.

1-11. Oxidation-Caused Spoilage. The most noticeable spoilage that results from oxidation is one that is associated with rancidity of fats. However, other oxidative spoilages that often go unnoticed are decreases in vitamin content, in flavor, and in color. Increases in temperature accelerate oxidation as does an increase of air penetration or other enhancement of oxygen. Oxidation can be partially controlled even though not completely eliminated in certain foods (fats, in particular) by adding various chemicals called antioxidants. These work by preventing the combining of oxygen with various food components.

1-12. Pathogenic Food Spoilage. Most disease-producing organisms which grow in food do not noticeably affect odor, color, flavor, or texture of the food. An occasional notable exception is botulinal food poisoning. Botulinum organisms can in some cases cause food spoilage in addition to releasing toxins or poisons within the food. While rare in commercially canned foods, many other preserved foods do contain living disease-producing organisms. Even though they are not spoiling the food nor in many instances growing, these disease-producing organisms will live for some time. Then, when the condition of the preserved food is altered to make the environment again acceptable to the pathogens, they will resume activity and can cause illness. One good example of this is salmonella organisms surviving in dried eggs. Once the dried eggs are reconstituted with water or milk, the organisms resume growth and have, in this way, caused outbreaks of salmonellosis in the United States.

1-13. Chemical Spoilage. The most prevalent chemical spoilage occurs in canned foods. The action of an acid food on iron in the can releases hydrogen gas and produces a deformity of the can recognizable on your inspection as a hydrogen swell. Highly acid foods such as canned fruits, sauerkraut, etc. are those most likely to be chemically spoiled by hydrogen swells. There are, however, other lesser known chemical spoilage factors. One such involves sulfur-containing foods (corn, for example) which turn black, because of the reaction of the sulfur to various other components in the food. Another fairly common occurrence is the chemical release of carbon dioxide (not related to bacterial growth) in canned syrups and molasses products. This spoilage will cause the syrup or molasses cans to bulge, yet it is neither dangerous nor unacceptable from an edibility standpoint.

1-14. Preservation of Nutrients. So far, we have developed that the primary aim of preserving food is to prevent spoilage. But there are other, more secondary, aims. The nutrients of the food must also be preserved. Included are carbohydrates, proteins, vitamins, and fats. Carbohydrates are attacked by molds, yeast and bacteria. Bacteria or enzymes decompose proteins. Heat, light, and oxygen tend to destroy vitamins, and fats are made rancid. The rate at which these nutrients are spoiled by bacteria, molds, yeasts, and enzymes is determined by the pH of the food, amount of moisture and free oxygen available, temperature, light, and the chemicals added to the food. Elsewhere in this chapter, we point out how each factor is controlled to help preserve the nutrients of food. Another help in preserving food is to prevent its contamination.

1-15. Prevention of Contamination. Food contamination can occur before, during, and after processing. When fruits or vegetables are first harvested, their skins may already have contaminants deposited by birds, insects, rodents, or other vermin. Furthermore, contamination may result from putting food stuff into filthy boxes, crates or other containers. Then, too, during slaughter of an animal, its meat may be contaminated by butchering tools or by the hands of employees. Later, while fruits, vegetables, and meats are being processed, they can pick up additional contaminants, particularly if insects and rodents are not controlled or if other appropriate sanitation measures are not observed in the processing plant. Then, after it has been processed, a food can be contaminated during transit or storage if rough handling causes its container to break or if its container is penetrated by insects, birds, rodents, or their excreta. Thus we see that the prevention of food contamination requires continual vigilance throughout the procurement, processing, shipment, and storage of foodstuffs. This will become increasingly apparent to you as we discuss the various methods of food processing, beginning with those involving the drying of foods.

2. PRESERVATION BY DRYING

2-1. How does drying prevent spoilage? In answering this question, let's first point out that foods are water systems. Milk, for example, is composed of 87.5 percent water, and cantaloupe is 94 percent water. Being largely water, foods are readily subject to spoilage, since bacteria, yeasts, molds, and enzymes multiply in a water medium. By removing water, then, we can slow down or prevent spoilage. For example, few bacteria and yeasts will grow in food with a water content as low as 30 percent by weight. In a food with a water content of no more than 10 percent, moist molds will not grow. With 1 percent water or less, the development of enzymes in food will be greatly retarded if not inactivated. The dehydration of foods, then, has a considerable effect upon ability to resist spoilage.

2-2. Overview. Water is removed from food by these methods: atmospheric drying, vacuum drying, and freeze drying. Associated with each of these processes are such disadvantages as changes in the porosity, flavor, and color of the food. Because of changes in porosity, dried foods often take a long time to rehydrate. Because of the evaporation of certain volatile substances, the flavor of food may escape or may change during drying. Due to a combination of amino acids and reducing sugars, fruits and some vegetables often darken when exposed to air during the drying process. To reduce darkening caused by drying, fruits are often treated with sulfur dioxide (sulfuring) or sodium bisulfite (sulfiting).

2-3. As well as having similar disadvantages, the drying processes have many steps in processing (unit operations) that are common. Let's briefly discuss these unit operations before we take up any of the individual drying processes.

2-4. Steps in Processing. Included in these unit operational steps are washing, trimming, dividing, blanching, sulfuring, and packaging.

2-5. Washing. Fruits and vegetables are washed to remove contaminants and thereby lower the load of microorganisms. This renders their preservation more easy to attain. Before eggs are shelled, and before various fruits are processed, they often are washed in a 0.5 to 2.0 percent lye water solution. The lye breaks down the waxy or fatty coating on the eggs or fruit and makes it much easier to remove soil. In the case of fruits, it also makes dehydration easier to accomplish Such products as wheat, oats, and other grains are not washed during processing, since they are naturally dehydrated, and washing water would only ruin the preservation process already accomplished.

2-6. Trimming. Fruits, vegetables, and meats are trimmed to remove bruised, wilted, or other undesirable parts. The trimming process,especially if it is done manually, is always a possible source of contamination for foodstuff.

2-7. Dividing. After fruits and vegetables are trimmed, they are usually halved, sliced, or diced in preparation for drying. Cereal grains, however, are dried before they are divided; that is, ground into flour or meal. The dividing process, whether done manually or by machines, is another source of possible contamination.

2-8. Blanching. To blanch means to expose to hot water. Blanching fruits and vegetables makes them easier to peel, cleans them, shrinks them by removing gas, and stops enzymatic action.

2-9. Sulfuring. Even though sulfuring does not kill bacteria, it does have a marked bacteriostatic effect, and as we have already pointed out, sulfuring also helps to reduce the darkening of foods caused by drying.

2-10. Packaging. During processing, fruits, vegetables, and meats are enclosed in suitable containers to prevent damage, contamination, and spoilage of the foodstuff. Since many dried foods are hygroscopic (water-absorbing), these containers must be waterproof. Likewise, containers should be lightproof if the foodstuff has vitamins that may be destroyed by sunlight. In most cases, packaging materials should also be impervious to oxygen. Howerver, with fresh meats and other foods similar in nature, it is desirable to have oxygen available to the product for color retention and other desirable effects. Included in the types of packagings used are various types of papers, plastics, and cans. Later in this chapter, we discuss each of these types of containers, but nowlet's turn our attention to the various drying processes.

2-11. Atmospheric Drying. Drying in the air is the oldest method of food preservation. Throughout many centuries, foods were dried in the sun for preservation. Among these foods were the cereal grains, fruit and meat (in the form of jerky). Atmospheric drying methods include sun drying, kiln drying, tunnel drying, drum drying and spray drying.

2-12. Sun Drying. Since grains are not harvested until the sun has removed much of their moisture, they are, in effect, sun dried for preservation. Other food is hung on racks or spread on trays so that it is directly exposed to the sun. Dried apricots, peaches, plums, and grapes are produced by this method. Moisture content is reduced to 18-24%. Since this method of drying is subject to the whims of the weather, we have no positive control over the process. Furthermore, sun drying exposes the food to possible contamination.

2-13. Kiln Drying. Foodstuff is placed on slotted or perforated floors above a source of heat called a kiln. Potatoes and apples are dried in this way. The reduction in moisture content ranges from 18 percent to 24 percent.

2-14. Tunnel Drying. The tunnel which is used in this method is about 35 to 40 feet long and 6 feet wide. The foodstuff is placed in trays, which are stacked on trucks, or on meshed conveyor belts at the tunnel entrance. As the trucks or belts move slowly through the tunnel, forced hot air is applied. The reduction in moisture content ranges from 7 percent to 3 percent. This method is used to dry fruits and vegetables.

2-15. Drum Drying. Liquid food with the consistency of puree is spread in a thin layer over the surface of a heated, revolving drum. When dried, the food is scraped off the drum with a blade. The drum may or may not be enclosed in a vacuum chamber to reduce the drying time. Foods dried by this method include milk, fruit juices, and certain vegetable purees.

2-16. Spray Drying. Food is mixed to form a solution or suspension which is atomized into a stream of heated air. This method is used to dry milk and eggs. It reduces the moisture content to as low as 2 percent.

2-17. Vacuum Drying. A low heat applied in a partial vacuum is used for drying foods that would be damaged by high processing temperatures. In this process, the food is exposed to a relatively low heat in a closed chamber under reduced pressure. Included in the foods dried by this method are soluble coffee, fruit juices and milk.

2-18. Freeze Drying. Freeze drying is a process wherein the foodstuff is quick-frozen and the resulting ice is transformed into water vapor by sublimation (a process of converting water in the solid state to water vapor without its passing through the liquid state). Sublimation is produced by the proper control of temperature and pressure during freeze drying. Let's breifly discuss the steps in freeze drying and its applications, and make a product evaluation of freeze-dried food.

2-19. Procedures. Steps included in freeze drying are freezing, vacuumizing, heating, removing vapor, breaking the vacuum, and packaging.

2-20. Freezing. The quick-freezing technique which freezes the product in a range from 0° C. to 5° C. in less than 2 hours is suitable. Meat items frozen by this process should not be over 1/2 inch thick. Materials to be frozen are placed on trays.

2-21. Vacuumizing the Chamber. Vacuumizing is done by steam ejection of air pumps, separately or in combination. The pump time must be rapid so that the product will not thaw. The operating vacuum must be less than the water vapor pressure over ice.

2-22. Heating. Heat is usually supplied to the ice surface by conduction from a heated surface in direct contact with the material. The amount of heat added to the frozen food is strictly controlled. It must all be used in the process of changing the water from ice to a gas, and no heat can be left to raise the food product temperature in even the slightest degree until the food is basically and completely dry. The materials are hollow plates through which hot water, steam, oil, or glycol is circulated. After pump-down, the plate temperature is raised to from 260° F. to 280° F. The plates are held at this temperature for 30 minutes. The heat is then shut off and the temperature falls slowly until the plate temperature is 140° F. Drying is completed when the temperature of the product rises to the same temperature as that of the heating plates. A more recent development is the use of hydraulic heating plates which apply a pressure of 8 pounds per square inch.

2-23. Removing Vapor. There are two ways to remove vapor. One method is called the steam augmentor and ejector system which extracts vapor from the cabinet; the other is the internal refrigerated surface-condensing system which condenses the vapor in the form of ice inside the chamber or in a condensing chamber.

2-24. Breaking the Vacuum. As free oxygen absorbed by the dried product will produce oxidative rancidity of the fat in meats, the vacuum must be broken in an atmosphere of dry nitrogen. Thus, in the unloading chamber, nitrogen permeates the porous tissues and excludes oxygen and water.

2-25. Packaging. Packages must be flushed with nitrogen or carbon dioxide to remove oxygen. The material must be moistureproof and lightproof and must be protective against abrasion from external forces. Boxes should be packed with desiccants to prevent the absorption of moisture.

2-26. Applications of Freeze Drying. Freeze drying appears to be the ultimate method of maintaining the functional taste and storage stability properties of certain foods. Foods which may be considered for preservation by this method include various meats, many fruits and vegetables and numerous seafoods. This method is of great advantage to the Armed Forces, because it gives us food products that approximate canned foods in storage stability and surpass them in quality. Then, too, freeze drying reduces transportation costs, since the weight is lessened through removal of the water. However, it seldom reduces space requirements, because freeze-dehydrated foods usually have the same cubic volume as do their fresh or frozen counterparts. An additional feature of this processing method is that since their cube is the same, their rehydrated appearance is much closer to that of the original product than are canned and other types of processed foods.

2-27. Product Evaluation. To assist in a nutritional survey of freeze-dried foods begin by reviewing all contract specifications concerning the food and its packagin and packing, plus any additional documenta material which may have accompanied the test requests. Once you are familiar with the contract requirements, you can then evaluate the adequacy of the packaging and packing materials, the amount of waste during preparation, the flavor, the rehydration characteristics, and the acceptability of the food by the consumer. Rehydration should be performed in a manner suited to the particular food. Normally rehydration of freeze-dried food occurs at a faster rate than it does in those which were only dehydrated. This characteristic is made possible by the fact that freeze-dried foods are more porous and cell structure has suffered less damage or distortion than in any other process of dehydration used today.

2-28. In all instances when beef, pork, or chicken is involved, once the food is rehydrated, it is subject to spoilage by bacteria, molds, yeasts, and enzymes. This is true even if rehydration occurs accidentally. Thus freeze-dried foods, as well as other types of dried foods, must be protected from moisture and other causes of spoilage.

2-29. Packaging, Protection, and Storage. To protect dried foods, packages are used that are impervious to gas (oxygen) and water vapor. Included are packages made of various types of plastics, aluminum-plastic laminates, wax paper, and cellophane-plastic laminates. These packages are protected from damage by various types of outer containers, discussed later in this chapter. Further protection is provided for these packages by storing them in areas where they are safeguarded from moisture, insects, rodents, other vermin, birds, excessive light, and excessive heat. However, dried foods do not require refrigeration for preservatio as some foods do.

3. PRESERVATION BY FREEZING

3-1. Food is often preserved by refrigeration, with resulting reduction in the activity of bacteria, yeasts, molds, enzymes, and chemical reactions. Oxidation and hydrolysis of food and the evaporation of its water content all occur slowly at cool temperatures. At 32° F., bacteria, yeasts, and molds grow slowly. However, enzyme activity and chemical reactions do not stop until the temperature drops to -40° F. or lower.

3-2. We see then that refrigeration of food offers several advantages. Let's briefly discuss: (1) the methods of refrigeration, (2) the unit operations of freezing food, (3) the deterioration of frozen foods, and (4) the thawing of frozen foods.

3-3. Methods of Refrigeration. Food may be refrigerated by means of ice, dry ice, or mechanical refrigeration.

3-4. Ice. Ice is used to refrigerate rail cars and to cool vegetables, poultry, and seafoods. Ice combined with salt lowers the melting temperature of ice and thus increases its cooling capability.

3-5. Dry Ice. Dry ice is solid carbon dioxide with a temperature of -110° F. It gradually passes from a solid state into a gaseous state without ever becoming liquid. It is used in ice cream and frozen food trucks and may also be used to preserve perishable foods if the compressor or motor of a refrigerator should fail. In the event a large amount of dry ice is used in a chill or freezer room, make certain to leave the door open if you enter the room. Otherwise, you may be overcome by a shortage of oxygen, since oxygen may be partially excluded by a high concentration of carbon dioxide gas. Remember this precaution since it could save your life or the life of another.

3-6. Mechanical Refrigeration. You are likely more familiar with mechanical refrigeration than with other types. Except for being larger, it is like the family refrigerator back home and includes such working parts as motors, compressors, and coils. In the Air Force some mechanical refrigerators are used to keep food chill others are used to insure that frozen food stays frozen.

3-7. Procedural Steps in Freezing. Included in these procedural steps (unit operations) are washing, trimming, dividing, and packaging - steps which we have already discussed in a general way. However, we shall examine some of the special considerations for packaging frozen foods and the procedures for freezing the food.

3-8. Packaging. To prevent freezer burns the packages for frozen foods should be gas impervious and should have no air pockets. Freezer burns are brown spots on meat caused by denaturing of the protein. These burns result from the cold dry air of the freezer dehydrating the meat and depositing its moisture on the coils of the refrigerator. Or such burns can result from air pockets in the packages adjacent to and around the meat. These pockets let the meat lose its moisture in the form of condensation deposited on the inside of the wrapper.

3-9. Freezing. Commercially, food may be frozen by either blast tunnels or plate freezers. Blast tunnels are high-velocity fans to circulate frigid air for fast and uniform freezing of the food. In plate freezers, each package of food touches plates which are in contact with cooling coils.

3-10. Commercially, too, food may be frozen by either the sharp (slow) or the quick method. In the slow process from 3 to 72 hours are required to lower the food to -20° F. This slow method has some disadvantages, one being that as freezing progresses water is withdrawn from the cells to form relatively large ice crystals between the cells. Then, upon thawing, these large crystals melt and the resulting water seeps out of the product more rapidly than it can be reabsorbed by the individual cells. Too, some of the large crystals will puncture or rupture cells and allow their liquid content to escape. This leaching or "drip" will carry some of the nutrients away and thereby lower the nutritional value of the product. Also, there will be excessive fluid loss during thawing, and the food will be drier than it otherwise would have been. Another disadvantage of the slow process pertains to those cells in which the walls are unbroken. Here, the loss of intercellular water causes the minerals to become so concentrated within the cells that they will not freeze. Not only that, but bacterial growth may occur in food during the freezing process, since it takes several hours for the internal temperature of the food to drop to 15° F. We see, then, that the slow freeze method has many weaknesses.

3-11. These weaknesses do not beset the quick freeze method, which freezes food in 90 minutes or less. In food frozen by this method, the ice crystals are small, so the cell walls of the food are not ruptured. Furthermore, the internal temperature drops below 15° F. so quickly that bacteria have little time to grow. After this processing, however, and while the food is in cold storage, some deterioration of the food does occur.

3-12. Deterioration of Frozen Foods. Frozen foods may deteriorate as a consequence of too high a storage temperature, fluctuating temperature, improper humidity, microorganism growth, enzyme activity, chemical reaction, or a combination of any or all of these. Let's briefly discuss each of these factors of spoilage.

3-13. Fluctuating Temperature and Relative Humidity. If frozen foods are to be preserved for their maximum length of time, storage temperature must be optimally low and constant. Temperature fluctuation causes conditions very similar to those which occur during slow freezing, in that it causes large ice crystal formation and the attendant nutritional deterioration. Depending upon the extent of the fluctuations, they can accelerate enzymatic chemical reactions. In the case of variations in relative humidity, when humidity is too low, the insufficient moisture causes drying of the stored food. In freezers, the effects of humidity changes are difficult to control by any means other than by suitable packaging. In chill rooms, humidity can be controlled by any one of several types of humidity control devices. When the humidity is below optimum, freezer burn results if the packaging is not intact. While freezer burn is a harmless condition, it is esthetically unacceptable and is irreversible.

3-14. Microorganisms. At temperatures above 15° F., molds and other organisms may grow rapidly enough to spoil food. But at temperatures as low as 15° F., most bacteria, yeasts and molds stop growing. However, some bacteria may grow at 0° F. - but not enough to cause spoilage. Even though freezing may decrease the number of vegetative organisms, pathogenic organisms may increase again when the food is thawed.

3-15. Enzymes. Freezing slows the action of enzymes but does not destroy them. When food is restored to normal temperature the enzymes resume their activity. Enzymes may lower the vitamin content and food value and may change the texture, appearance, and flavor of food.

3-16. Chemical Reactions. Chemical reactions are reduced as food temperature is lowered. Such actions include color changes, fat oxidation (rancidity), vitamin destruction (by oxidation or other reactions), flavor changes, and many others. However, remember that chemical reactions do continue in frozen foods but only at a slower rate. This is the reason that even those frozen foods stored under optimum conditions do not indefinitely retain their quality but, instead, deteriorate to the point where they are unacceptable to the consumer. Both excessive dehydration and freezer burn can accelerate oxidation, since the removal of water from the surface tissue permits oxygen penetration to a greater depth within the food. Hence there may be very pungent areas of rancid fat immediately under the freezer-burn area. Again the best control is optimally low and constant frozen food storage temperature.

3-17. Optimum Storage Temperature. Regardless of the storage temperature, freezing will not reverse damage already done to food. Food keeps its own history - a cummulative record of damage done to it. In storage the damage continues at a greater or lesser rate, depending upon the storage temperature. As shown in the chart below, the lower the temperature, the longer it takes for food to develop a slight lessening of quality. (NOTE: The chart is a typical example only and cannot apply to all foods, since many of them will retain quality longer than 2 to 3 days, even though stored above 20° F.)

Storage Temperature	Time Required for Slight Lessening of Quality (Off-Flavor)
0° F.	1 year
5° F.	5 months
10° F.	6 weeks
15° F.	3 weeks
20° F.	1 week
Above 20° F.	2 to 3 days

3-18. Additional Storage Facts. Before leaving the storage of frozen foods, let's point out these additional important facts.

a. The longer the storage, the larger the ice crystal, so remember FIFO (first in, first out) for all refrigerated items.

b. The greater the temperature fluctuation, the larger the ice crystals, so make certain that refrigerator doors are kept open no longer than absolutely necessary.

c. Freezing food will not reverse damage already done to it, so don't try to freeze partially spoiled food to rejuvenate it.

d. No microorganisms will grow in ice crystals, but they will grow in the unfrozen fat of refrigerated meat.

e. Any microorganisms that grow in frozen food are not pathogenic: they may make food taste bad, but they are not injurious to health.

f. In the freezer, nutrient loss is progressive and sure: beef and nonfatty fish are good for 1 year; pork is good for 6 to 7 months; and fatty fish are good for 5 months.

g. Don't load an open-top (display type) deep freeze unit above the load line arrow. The top layer may thaw.

3-19. Thawing. As we have already pointed out, food should be frozen rapidly so that small ice crystals form, cell walls remain unbroken, and cells retain most of their moisture. But what about thawing? Frozen beef and pork should be thawed slowly in the refrigerator so that the cells have time to reabsorb any moisture they have lost during freezing. But fish should be thawed rapidly, preferably by cooking since slow thawing may denature fish protein. Thawing by cooking is a must for frozen vegetables and certain fruits. Some meats, too, may be cooked from the frozen state provided it is done starting directly from the frozen state.

3-20. Now let's consider accidental thawing and what you can do about it. On rare occasions, frozen foods may thaw in transit. In other instances, thawing may result from electrical power failure or from mechanical failure of a refrigerator. In either event, if failure is likely to be prolonged, dry ice (if available) should be quickly used to keep refrigerated foods frozen. If frozen food begins to thaw in spite of precautions, what should be done with it? Should it be refrozen? No, it should not. The Air Force has freezers to maintain previously frozen foods but does not have blast freeze facilities to quickly refreeze the food. Thus, since the food would have to be slowly refrozen, it would have time to deteriorate and to develop off-odors.

3-21. What, then, should be done with the thawed food? The answer to this question depends upon the internal temperature of the food, the length of time it has been at this temperature, and the type of food it is. If it is a nondangerous item such as are plain fruits and vegetables or if it is a highly acid item like cheese, sauerkraut, etc. the length of time outside its proper storage temperature is not as critical as it would be in a more dangerous food item. In this respect, such foods as creamed meats and some creamed vegetables are very dangerous and have narrow margins of safety. If the internal temperature has gone much over 40° F. for over 4 hours, condemn the food. When you know that the particular food is one which would not spoil in the period of exposure to improper temperature, the food should be force issued and used within 24 hours as a chilled-food item. If the food is still solidly frozen but its internal temperature ranges upwards to 20° F., it should be placed in another freezer and the temperature taken back to 0° F. or to whatever is optimum in your warehouse. However, it should be identified by suitable markings so that it can be issued ahead of similar products which have not been distressed by being partially thawed in fluctuating temperatures. Force issues can be authorized only by the base commander upon the recommendation of the veterinary officer or his representative. Such actions should, of course, be coordinated with the commissary officer and/or the food service officer. This will insure that use can be made of the product within the time limit you specified.

4. PRESERVATION BY CANNING

4-1. Canned goods are the safest of the preserved foods. Some advantages of canning are: (1) seasonal food surpluses can be preserved for year-round consumption; (2) foods can be preserved and used anywhere in the world; (3) the canned products are available for consumption with a minimum of preparation; (4) the wastes are removed before canning; and (5) minimum storage space is required. Some specific military advantages of canned foods are that individual combat-canned rations have been developed for use in the field and that the sealed can protects foods from nuclear, chemical and biological contamination. Let's breifly discuss unit operations and packaging of canned goods.

4-2. Unit Operations. Foods to be canned must be harvested and prepared under close supervision. Included in the steps of processing these foods are cleaning, dividing, blanching, filling cans, preheating, heat processing, and cooling. Cleaning, dividing, and blanching have already been discussed in this chapter. The cans may be filled either by hand or by machine. Preheating, before the cans are sealed, is done either by using already heated food or by passing the unsealed can of food through a hot water bath or steam tunnel. Preheating drives off gas to give a solidly packed can and helps to blanch the food. After the can is sealed, heat processing or retorting, as it is called, is done by placing the sealed can in pressure cookers and exposing the canned goods to various combinations of temperature and time. The temperature and time depend upon the pH of the food product involved. The usual retorting time and temperature is 3 minutes at approximately 250° F. if the food is not very acid. For fairly acid foods, this time and/or temperature may be reduced. Highly acid foods may not be subjected to any heat processing. Heat processing not only destroys any undesirable microorganisms present but also cooks the food to the desired degree and stops enzymatic action. The time and temperature of 250° F. for 3 minutes used in processing nonacid foods is based upon the fact that this is the minimum combination capable of killing those bacteria which cause botulism. Following the heat treatment, the cans are flooded with cold water to cool quickly. This stops cooking and drops the temperature of the can to about 95° F. Even though 95° F. is warm enough to help dry the cans, this temperature is too low to allow the growth of thermophiles, which grow rapidly between 115° F. and 125° F. When canned foods have been adequately processed, they are called "commercially sterile." This term means only that under all normal conditions there will be no microorganism growth within the sealed can. Commercially sterile does not mean that all microorganisms have been killed, as would be the case with surgical sterility from an autoclave. Another form of heat processing now in general use is called "aseptic canning." In this process the food is flash sterilized by being exposed to surfaces superheated by superheated steam to temperatures close to 400° F. At the same time the food is being flash sterilized, the cans and lids are also being flash sterilized under superheated steam. The food, then, does not leave the sterile chamber but rather is brought together with the sterile cans still within the sterilizing chamber and is canned and sealed in these aseptic conditions. The result is a basically sterile product having extremely long keeping qualities. This process is currently being used primarily to prepare the so-called sterilized milk and other dairy products such as ice cream mixes.

4-3. Packaging. Canned food containers may be glass or metal cans made of tinned steel or of aluminum. The use of glass is generally limited to foods which are not highly perishable. The advantages of glass are that it is cheaper and the consumer can see the contents. Its disadvantages are that it breaks easily and that food in it cannot be processed under high temperatures and pressures. Cans do not have these disadvantages.

4-4. Cans are manufactured from steel base plate to which a thin film of pure tin has been coated electrolytically. Various types of enamels may be used to protect the interior surface of some cans. However, many canned food items are placed in cans with no enamel coating. Enamels are placed on the inner surface of cans to inhibit undesirable reactions between the metal and the product. Such reactions may produce hydrogen swells (hydrogen gas released inside the can) and discoloration of the product. To be suitable for use inside of cans, enamels must be nontoxic, must not react with food, must withstand fabrication without chipping or flaking, and must adhere firmly to the tin plate.

4-5. Two types of enamel are used inside the cans. These two are R enamel and C enamel. R enamel is used for pigmented fruits and vegetables to preserve their natural color. C enamel, which contains 15 percent finely powdered zinc oxide, is used for canned corn, meat, fish, and poultry products. Without this enamel, the sulfides released in protein breakdown react with tin to form black tin and iron sulfides. With the coating of zinc, the sulfides react with zinc to form white zinc compounds which are not objectionable in appearance.

4-6. Before leaving our discussion of cans, let's briefly consider the external coatings applied to some cans to prevent corrosion and to provide camouflage. There are three types of these coatings. Type I is a precoated camouflage that is applied before fabrication of the can. The side seams of the can must be painted after retorting (after the can has been sealed and its contents cooked). Type II is a postcoated camouflage that is applied after retorting. It may be applied by brushing, dipping, or spraying. Type III is precoated and unpigmented. Known as "gold enamel," it may be applied before or after retorting.

4-7. We can see, then, that cans have been carefully designed to protect the food. Their excellent design combined with the superb modern processing techniques now used in canning have practically eliminated the threat of food poisoning from commercially canned products in this country.

5. RADIATION PRESERVATION

5-1. Radiation includes such low-frequency radiations as electrical, sonic, and radio waves. Also included are such high-frequency radiations as alpha, beta, and gamma rays; X-rays; electrons; and neutrons. Here, in our discussion of food technology, we are primarily concerned with electrons and gamma rays.

5-2. Just as X-rays can be used to kill cancer cells, gamma rays or electron radiation can be used to kill microorganisms and insects in food. Electron radiation derived from electro accelerators and gamma rays derived from Cobalt-60 have been used to keep potatoes from sprouting, to kill insects in grains, to delay ripening of fruits, to speed the ripening of fruits, to kill salmonella in eggs, to kill trichina in pork, and to preserve bacon and various other kinds of foods. A medium level of radiation (100,000 to 1,000,000 rads) kills nearly all the microorganisms, but the product is not rendered completely sterile. Perishable foods treated in this way have a longer shelf life when they are stored under refrigeration. Exposures of 1,000,000 rads cause certain foods to lose quality. Large doses of radiation (up to several million rads) have been used to sterilize some foods but may cause softening of vegetables and off-flavors in meats and fats. Recent findings indicate that if foods are irradiated at low temperatures, such off-flavors are reduced. Furthermore, findings show that the use of gamma rays on foods do not produce toxicity or radioactivity in those foods.

6. PRESERVATION BY FERMENTATION

6-1. During fermentation the pH of a food is lowered and the acid formed helps to preserve the food. For example, the natural sugar of a food may be changed by microorganisms (bacteria or yeasts) in turn, to lactic acid, then to alcohol, and finally to acetic acid. Either lactic or acetic acid will act as a preservative by lowering the pH of various foods. In the majority of those foods preserved by fermentation, the process is accomplished by formation of lactic acid rather than by acetic acid. For example, cheeses, sauerkraut, olives, etc., are all preserved by lactic acid. The pH resulting from fermenting foods is adequate to prevent growth of all pathogens. However, it will not prevent growth of a few types of spoilage microorganisms, nor will it effectively stop enzyme activity. Hence, many fermented foods, such as sauerkraut, must be pasteurized and canned or bottled, if indeed they are not actually heat processed. Here, let's discuss sauerkraut and cheese as examples of processing by fermentation.

6-2. Sauerkraut Production. Sauerkraut is produced from cabbage. The cabbage is washed, shredded, and salt is added to achieve a concentration of 2.25 percent to 2.5 percent. The shredded kraut is packed in vats and weight is applied to submerge it in the brine solution. The temperature is held at 70° F. to 75° F. during lactic acid fermentation. When the right amount of acidity is produced, either heat or cold is used to stop the fermentation. Most sauerkraut for the Armed Forces is canned and subjected to heat treatment during canning.

6-3. Cheese. The principle function of bacteria in cheese making is to produce acid. The action of bacteria helps to curdle milk, expel whey, gather the curd, and protect against putrefaction. Bacteria and molds are responsible for the different flavors of cheese.

7. CURING

7-1. Curing is a method of preserving or imparting a particular flavor to various meat products. Salt is the basic curing agent, but it may be supplemented with other agents, such as sodium nitrate, sugar, spices and many other supplementary products. The primary objective in curing meat is to prolong its keeping quality. This is done by saturating tissues with salt which eventually destroys most of the microorganisms. The salt does not destroy all pathogens; the curing process will not make trichinae-infested pork safe.

7-2. Meat was originally cured in order to preserve it. The need to cure meat for this purpose is not as great today as it was originally, because refrigeration is available now. Consumers have the same eating habits they had before refrigeration was developed, and they still demand the flavors and colors of cured meats.

7-3. Salt. Salt used in the curing formula may be used alone or with other ingredients. Salt is basically a preservative, it extracts moisture from meat, and imparts flavor. Salt also tenderizes foods, especially the skin of vegetables. Salt in a 15-percent solution will preserve foods, control enzymes, help remove water, and prevents the preserved food from absorbing metal from the can. When used on meats, however, salt does destroy their color. This is why nitrates and nitrites must be added if a pink or red cast is desirable.

7-4. Sugar. The preserving characteristics of sugar are similar to those of salt, however, sugar does not have these characteristics to the extent that salt does. Sugar adds flavor, removes some moisture, tones down the brackishness of salt, and furnishes food for desirable bacterial growth in the curing process. Excessive amounts of sugar do not enhance the keeping quality of meat, but they may cause it to turn dark red. Sugar is also used with sodium nitrate in the curing of meat. There the sugar feeds essential bacteria which reduce sodium nitrate to sodium nitrite.

7-5. Nitrates. Sodium nitrate and potassium nitrate act as reservoirs for nitrites, thus maintaining an effective level of nitrite for the curing of meat products.

7-6. Nitrites. These are produced from the reducing bacteria acting on sodium or potassium nitrate. Nitrite unites with hemoglobin or myoglobin to form nitric oxide myoglobin which, in the presence of heat, yields nitric oxide myochromogen (a stable color). Nitrite salts may be added to the nitrates to insure having enough nitrite for color fixation. The quality of nitrites added (maximum of 200 ppm) must be carefully controlled by MID to avoid creating toxic effects.

7-7. Pickle. The term "pickle" as

applied to meat curing, means a solution of the curing agents. Plain pickle is simply a solution of salt in water. Compound pickle contains salt, sugar, and/or sodium nitrate and/or sodium nitrite. Pickle that contains sugar in some form is also known as "sweet pickle."

7-8. Smoke. Egyptians and ancient Sumerian civilizations smoked meat. In North and South America, the Indians smoked meat over the tops of their tepees. The smoking had some drying and preservative effect from the heat and the release of pyroligenous acid in wood smoke. Today, meat is smoked mainly to give it flavor and colors. Preservation is accomplished by the curing process.

7-9. The objectives of smoking meat are to remove moisture to retard bacterial growth; to impart a desirable smoked flavor; to stabilize a cured color; to prevent oxidative rancidity; and to kill surface bacteria.

8. USE OF FOOD ADDITIVES

8-1. For centuries man has used additives to preserve food. A good example is salt (sodium chloride) which has been used since ancient times. Today, through advances in chemistry and food technology, inorganic and organic chemical compounds may be added to food to stop the growth of microorganisms without injuring the food. The uses of chemical preservatives in foods are closely controlled by the Food and Drug Administration, which has enforcement responsibility for the Federal Food, Drug, and Cosmetic Act, which regulates foods that enter interstate commerce. Some of the established criteria pertaining to the use of chemicals are that they must (1) not injure the consumer, (2) improve the food material, (3) not reduce action of digestive enzymes, (4) not react to form harmful compounds in the body, (5) be easily identified, and (6) be proved safe before use.

8-2. Included in the additives used in food are sugar, acids, salt, antibiotics, sulfur compounds, oxidizing agents, antioxidants, enzymes, and food flavor amplifiers. Let's discuss these allowed additives and then briefly consider a few forbidden additives.

8-3. Sugar. This additive is used to give color and, especially, flavor to food and to help preserve certain fruits and meats. Sugar, for instance, is used in bread to help it to brown. Sugar is also used with sodium nitrate in the curing of meat. There the sugar feeds essential bacteria which reduce sodium nitrate to sodium nitrite. In addition, sugar is used to preserve fruit, in which case about 25 percent (by weight) of sugar is required. However, this percent can be reduced somewhat on more acid fruits, since sugar and acid are synergistic in their control of bacterial growth.

8-4. Acids. Acids are used to improve the flavor of foods and to help in food preservation. Included among the acids used in foods are the benzoates, the propionates, citric acid or citrus juices, acetic acid, and phosphoric acid. Acids are added to foods to attain a pH that is unacceptable to those organisms which may be present. While to some persons they enhance food flavors, to others they may harm the taste. From a practical standpoint, this information is usable at your station, if you realize that when potato salads are acidified to a 4.5 pH level, they are much safer to serve than are normal, rather bland and sweet potato salad concoctions. This, also, is the reason various fruit and lemon-custard-type pies need not be refrigerated. They, too, have a low pH. We shall now discuss two more acids commonly used in preserving foods.

8-5. Benzoates. Benzoic acid in a concentration of 0.1 percent is fairly effective against the growth of yeasts. Its bacteriostatic action is enhanced by adding side chains such as phenylbutyric acid. Esters of vanillic acid (a derivative of P-hydrobenzoic acid) are effective against many microorganisms including molds and some heat-resistant spore-forming bacteria. The use of ethyl vanillate in World War II made it possible to deliver acceptable foods to many parts of the globe.

8-6. Propionates. The salts of propionic acid (fatty acid) are nontoxic; they are used to inhibit mold in bread and cakes. Propionates are also used to inhibit surface mold growth in cheese. Soft cheeses, such as cottage cheese and cream cheese may be protected from mold by the addition of 0.15 percent of calcium propionate.

8-7. Salt. Used to improve flavor, salt also tenderizes foods, especially the skin of vegetables. Salt in a 15-percent solution also preserves foods, controls enzymes, helps remove water, and prevents the preserved food from absorbing metal from the can. When used on meats, however, salt does destroy their color. This is why nitrates and nitrites must be added if a pink or red cast is desirable.

8-8. Antibiotics. These are chemical substances which are produced by certain living cells, such as bacteria, yeasts and molds. They may prevent disease-producing or spoilage organisms from multiplying or else kill them. Two antibiotics, oxytetracycline (or terramycin) and chloretetracycline (or aureomycin), have been approved as antibiotic additives for chicken and whole gutted fish. Their use slightly extends the shelf life for these two highly perishable products. It is debatable whether their use is really worthwhile, when weighing such disadvantages as creating resistance to these antibiotics in certain bacteria. In the canning industry two antibiotics which show promise in accelerating speed in killing spores are subtilin and nisin.

8-9. Sulfur Compounds. Sulfur dioxide and sulfites are used in the preservation of acid fruits and vegetables. They are effective against molds, but are not very effective against yeasts. The surfur substances may reduce food palatability and may inactivate some vitamins. Fruits are sulfured by burning sulfur or exposing fruit to sulfur dioxide gas. Apples may be dipped in a solution of sodium bisulfite or sulfur dioxide.

8-10. Oxidizing Agents. Oxidizing agents are used in meat, fish, flour, and vegetable preservation. Sodium nitrate and sodium nitrite are used in meat curing. These are broken down to nitric oxide, which is a color fixative. Bleaching agents are used to preserve flour. Other oxidizing agents used are ozone (to destroy mold spores and airborne bacteria) and sodium hypochlorite solution (to inhibit mold growth on fruits).

8-11. Antioxidants. Antioxidants are substances which are added to food to protect it chemically against oxidation. A common form of oxidation is the rancidity of fats. This oxidation or oxidative rancidity may develop and be accelerated by light, air, moisture, heat, and catalysts such as copper. Included in antioxidants are the tocopherols, cephalin, gum guaiac, propyl gallate, ascorbic acid, citric acid, and hydrochloric acid. The tocopherols (including Vitamin E), which come from vegetable oils, are good antioxidants for animal fats. Cephalin, which comes from soybean lecithin, is a good antioxidant. Gum guaiac is an antioxidant and stabilizer for many fats, including dehydrated fats. Propyl gallate, not to exceed 0.01 percent, is permitted to preserve lard. Ascorbic acid is used to prevent rancidity of mayonnaise and to prevent browning of the unprocessed cut surfaces of such fruit as peaches, apples and apricots. Two percent citric acid or 0.1 percent hydrochloric acid are also used to prevent sliced peaches from browning.

8-12. Enzymes. These substances are used to break down connective tissues and thus to tenderize meat. Enzymes include papain, bromelin, ficin, and asclutin, each of which is heat labile.

8-13. Flavor Amplifiers. Included in the flavor amplifiers are monosodium glutamate and many spices. With a few exceptions, these flavor amplifiers are not food preservatives. However, some spices, such as cloves and cinnamon, are bacteriostatic to some degree and some are even bactericidal in certain situations.

8-14. Artificial Sweetener and Miscellanous. Artificial sweeteners are widely used in dietary foods as well as in many other foods consumed with no dietary intent. Artificial sweeteners have no food preservation quality as sugar might have. Consequently, foods that might have been preserved had they contained a high sugar content are not preserved if sweetened solely by artificial sweeteners. Many thousands of other food additives are approved for use under the guidance of the Food and Drug Administration. All have specific criteria for use and some are toxic if applied beyond the limits intended for their use. Others have special disadvantages in their use. Questions concerning additive usage should be referred to the closest Food and Drug Administration representative.

8-15. Forbidden Food Additives. Among the forbidden food additives is sodium sulfite, a toxic substance sometimes used illegally to redden stale meat. Also included are sodium nicotinate, salicylic acid, peroxide, and quaternary ammonia compounds. And, except for use on poultry and fish, antibiotics are also forbidden.

9. PACKING AND PACKAGING.

9-1. Food must be packaged (placed in an individual container or can) and then packed (several packages made ready for storage and shipment) in various manners so that wholesome food can be delivered to military installations all over the earth. Your job will include ability to recognize markings and labeling, and, in some instances, the capability to inspect for proper packaging and packing in terms of the contract. There is a tendency to overemphasize the inspection of food and to underemphasize the inspection of the package or container. In this section we will look, in a broad general sense, into the purpose of packaging, discuss the types of packages (both tin and glass can, and flexible), and then take a brief look at packing materials used to "pack" the packaged products.

9-2. Purpose of Packaging. Foods for military consumption must be stored in all kinds of climates. The package protects the food and serves as a convenience in using and handling. The package or container must protect from moisture, excessive heat or cold, insects, rodents, some pressure from weights in storage, acids, alkalies, oils, and damage caused by rough handling (it is evident that the packing aids many of these protective functions). Yet the container must not impart any odors, tastes, or toxic material which the food can absorb. A perfect package has not been developed, but new developments tend toward increased tensile strength, lighter weight, and increased resistance to vapor, to temperature variations, and to flammability. For convenience to the military services, the weight, strength, and size of the container are important. Consideration must be given to reduction of shipping costs, to shipping problems encountered in moving products from warehouses to using facilities, and to the placement of the products into shelves and refrigeration equipment of dining facilities. Individual containers must be easily opened with standard Air Force dining hall equipment. Packages must be labeled for proper dining hall identification.

9-3. Types of Packages. The individual containers easily fall into two general categories - rigid and flexible packages. Tin cans are still the most prevalent form of container used in packaging, but are being replaced by the aluminum can and the glass container, which is also classified as a can in a broad sense: "a jar for packing or preserving fruit." Cans also can be classified as to method of filling. An example of a vent filler can would be an evaporated milk can, spot soldered on the end at the spot where the milk is injected. An example of the hole and cap would be the Log Cabin syrup can or the Wesson oil container. An example of the sanitary can would be the ordinary can; for instance, a normal tin can constructed of cold rolled steel coated with tin and soldered at the ends. As has previously been pointed out, cans are enameled to protect the product. The first digit of a can size reflects the whole number of the size, in inches; the next two digits, the fractional inches in sixteenths. Thus, a can size "401 x 412" is a can whose diameter (first three digits) is 4 and 1/16 inches, and whose height (second three digits) is 4 and 12/16 inches (4 3/4 in.). In the diameter example "401," note the zero used as a filler.

9-4. Flexible packaging materials are numerous. Of interest is the imperviousness (not allowing passage) of the material to light, gas, or water vapor. Let's start with one of the earlier developed wrappers, waxed paper. If waxed on but one side it is only considered impervious to water vapor. Aluminum foil is impervious to vapor, gas, and light, but is not considered good as a commercial wrapper unless laminated with other materials because of loss of imperviousness when wrinkled (it cracks). Cellophane is not tough and is water pervious. It is oxygen and gas impervious until wet. Since meats must be packed so oxygen can get in and permit breathing, cellophane is often used because the meat juices wet the cellophane enough to permit the passage of oxygen. Cellophane is often laminated with other wrapping materials. Saran is a wrapping material impervious to everything. Polyethylene is tough and water impervious, but it is pervious to gases and is shrinkable. On the other hand, polyvinyl chloride is pervious to oxygen, strong, water impervious, and does not shrink. Mylar (Scotchpack) is a wrapping used when foods are to be cooked in the package. It is the strongest, most resistant of the flexible packaging materials, and furthermore is also a chemical repellent, and is water and gas impervious. Amino acids can be synthesized into any meat or container, creating an interesting flexible packaging material called synthetic protein film. When used to wrap synthetic hams, chickens, etc., the consumer actually eats the package! In addition, using the amino acids as a source, many synthetic meats (ham and chicken, for wxample) are on the market today.

9-5. Purpose of Packing. Packing is the grouping of a number of small packages or units into one larger unit or pack, using such materials as are necessary to protect against mechanical damage, loss, pilferage, dirt, contamination, moisture or other conditions which may affect the wholesomeness or storage life of foods.

9-6. Packing Materials. Packing materials used are paper, cloth, wood, metals, and synthetics such as fiberboard. Packs include boxes, crates, bales, bundles, sacks, bags, drums (metal or fiber), fiber cans, wooden barrels and kegs, miscellaneous packs, and palletized unit loads. Marking for shipment and storage is in accordance with applicable military standards but, in general, for perishable subsistence convey this information:

. Item description and grade (or brand).

. Quantity, size, unit, and total net weight.

. Gross weight and cube.

. Date packed (month, day, year).

. Contract or purchase order number; name and address of contractor.

. Special markings.

The standard markings for perishable subsistence will not apply to fresh fruits and vegetables. Such markings are made as specified in contract or purchase order.

10. COLD STORAGE PRACTICES

10-1. More than half of the military ration consists of perishable items that require refrigeration. You will inspect the following foods in a cold storage environment: fresh and frozen meat and meat products; fresh and frozen fish and other waterfood products; poultry, eggs, and dairy products, fresh fruits and vegetables; and other frozen foods. To reflect job practices we will briefly review the functional parts of a cold storage plant and will discuss general storage practices that are essential for well-informed inspectors to know.

10-2. Parts of a Cold Storage Plant. Let's take a paper visit to a typical cold storage plant and look at the freezer storage room, the meat chill room, the cooler rooms, and the ventilated storage room.

10-3. Freezer Storage Room. Ideally you will find the freezer storage room maintained at a temperature of from 0° F. to -10° F., with a minimum of temperature fluctuation. All food items that are frozen when received will be found stored here. Especially watch for subsistence items that deteriorate in prolonged storage (such as pork, sausage, frankfurters, salami, precooked frozen inflight meals, TV dinners, and meat pies) - they must be stored at temperatures no higher than -10° F. if at all possible. If you notice food products stacked with stripping (pieces of thin boards) between tiers, it can indicate that the food product was received at 20° F. or above and was, therefore, specially stacked to insure circulation of cold air around the containers. Stacking will be further discussed later. Other foods received at below 20° F. will normally be found piled into compact stacks without stripping between tiers.

10-4. If you find the contents of a container removed and scattered, it probably indicates that a product was received partially defrosted. It was scattered so that it would refreeze quickly, as any accepted partially defrosted item must be refrozen without delay. You may find a fan being used to allow the cold air to circulate rapidly in such cases. If not, recommend such practices if they are necessary. You should also make sure that these refrozen foods are always marked in some way so that the refrozen lot can be issued before other products in the same category are used, since those which were refrozen have markedly shortened shelf life. Good inspectors insist that frozen beef carcasses be hung if at all possible. Under no normal circumstances do wholesome practices permit food to be frozen in the freezer room, since freezing takes place too slowly, and the result is a product of inferior quality.

10-5. Meat Chill Room. As we continue our inspection tour, let's enter the meat chill room (or rooms). Notice the temperature is maintained from 30° F. to 32° F. Suppose that an error has been made and the temperature held below 30° F. Slow freezing of the product would have resulted, and you could expect to find discoloration and loss of quality in the product. But this is a rare occurrence. You can expect to find the following items normally stored in the meat chill room: fresh meat and meat products, fresh poultry and smoked or salted ham and bacon. But fresh pork and pork sausage usually require a lower storage temperature. If, as is often the case, this is the only meat chill room available, the pork should be stored in the coldest part of the room for no longer than 48 hours, and a good inspector will be alert to guard against other practices endangering the wholesomeness of the product.

10-6. Cooler rooms. On an inspection tour you would normally find at least two cooler rooms provided. Dairy products, eggs, lard, and lard substitutes will be stored in one room; while, to prevent the transfer of taste and odors, fresh fruits and vegetables will be stored in another room. (This excepts those less perishable items stored in the ventilated storage room). You should find both cooler rooms maintained at 35° F. and again the temperature should not be allowed to fluctuate. Careful control of the velocity of the refrigerated air is necessary. Dehydration and damage to the stored food will be points to look for on inspection. This could indicate excessive velocity. If your base does not have a ventilated storage room, or if they are not using it to store such items as cucumbers, eggplant, tomatoes, etc. make sure that the fruit and vegetable cooler room mentioned above is not held below 40° F. Temperatures below 40° F. can damage some fresh vegetables.

10-7. Ventilated Storage Room. You will find the less perishable fruits and vegetables, such as potatoes and apples, usually stored in a well-ventilated storage room. Sometimes refrigeration may be available, although in cold climates it may at times be necessary to heat the room to prevent the room temperature from dropping below 38° F. The room is preferably maintained at 40° F. If white potatoes are stored at a temperature below 40° F., they will develop a sweet taste, so keep this in mind while inspecting. Common foods that you may find stored in ventilated storage are apples, avocados, beets, citrus fruits, cucumbers, eggplant, dried fruits, honey, canned meats, honeydue melons, onions, parsnips, pears, peppers, potatoes, pumpkins, squash, tomatoes, turnips without tops, and canned evaporated milk. The following points are of interest to you as an inspector: food is stored here only to lengthen shelf life; temperature control is involved as well as ventilation (honey, canned goods, etc.); pinpointing caused by condensation forming on cans may denote inadequate ventilation; and honey turning to sugar denotes improper storage temperature. Space availability is a factor as to placing a product in the ventilated storage room.

10-8. Factors Affecting Cold Storage. What factors which accelerate spoilage can you help control in your inspection? Let's name them: (a) Lack of heat withdrawal from product as reflected when packages are not adequately spaced. (b) Rough handling (not much you can do). (c) Incorrect humidity (some items need more than others - if the situation cannot be controlled, recommend these items be issued at an earlier time). (d) Mold mildew resulting from too much humidity. (Recommend that door be kept closed as much as possible and if mildew is still a problem, follow these procedures.) Scrub the walls with detergent and water, followed by a plain water flushing, then by a flushing with quaternary ammonium compound or, if such is not available, with clorox solution. (e) Lack of ventilation (control the height of stacks off floor and the distance from wall, and use stripping). (f) Crushing (recommend that bags not be stacked more than four or five high). (g) Make certain of stock rotation. (This is probably the most important existing warehousing provision. FIFO - first in, first out - should be everyone's byword.) (h) Fluctuating temperatures (examine temperature records). (i) Defrost units (ascertain if defrosting was adequate).

10-9. General Storage Practices. These are general practices and terms concerning stacking, dunnage, and ventilation. Stacking is the placement of packaged items and carcass meat in neat, compact stacks, with spaces of 4 to 6 inches left between the food and the wall, and 18 inches left between the top of the stack and the ceiling. Floor dunnage (62- x 4-inch strips of wood or metal) is frequently used to keep food products from touching the floor and to allow air circulation. The amount of ventilation necessary depends upon the commodity stored. For instance, fresh fruits and vegetables require ventilation in the stack, although cases or boxes can usually be stacked so there are ample air spaces inthe stacks. Shell eggs in wooden cases need not be stacked with wooden stripping if stored only a few days. But if they are in fiberboard cartons or are to be stored longer than a few days, the tiers must be separated with wood stripping. Tiers of boxes or cartons containing fresh meat products must be separated with stripping of thin boards or laths.

10-10. Frozen meat and meat products, poultry, fruits, and vegetables received at temperatures below 20°F. and solidly frozen are correctly stored for stack ventilation if the dunnage on the floor is at least 2 inches thick and the product is stored 4 to 6 inches from the wall. As was earlier indicated, items received at temperatures higher than 20° F. are correctly stacked with stripping.

10-11. Humidity. Another factor influencing quality is humidity. It is a general term descriptive of wetness or moisture content of the air. Relative humidity is the ratio of water vapor actually present in the air compared to the greatest amount of water vapor possible in the same air at the same temperature. Each degree of temperature change affects the relative humidity. A rising temperature increases both the rate of evaporation and the capacity of the air to hold water. Guideline for the storage of food commodities, including RH, are found in AFM 145-1.

11. DRY STORAGE PRACTICES

11-1. Nonperishable subsistence can generally be defined as foods which can be stored without refrigeration, such as canned goods, sugar, flour, condiments, cereals, preserves, salt, and dehydrated foods. The guide for dry storage warehousing layout is in AFM 145-1, Commissary Operating Manual. The Veterinary Service inspects storage facilities for sanitation and adequacy for preservation of all subsistence. Points to check in inspecting nonperishable storage facilities are the use of pallets, heating facilities, ventilation, security, insect and rodent control, storage charts and markings, and epidemic spoilage. Let's discuss each of these items and other general dry storage practices.

11-2. Use of Pallets. Pallets are usually 40 x 48 inches in size. However, cargo pallets, which may be used to store heavy materials, may be 48 x 72 inches. As you know, pallets are designed so that forklifts can move them with their contents and yet sturdy enough to withstand the weight of foods stored. You will also inspect another type of pallet, the box pallet, which has a standard pallet base with a vertical and top framework. This pallet is designed to store odd-sized and odd-shaped containers, or containers which are easily crushed. So observe them for evidence of crushing. You will need to check the air space under the foods for adequate cleanliness and to see that provision has been made to complement effective rodent control. There should be enough space for placing rodenticides but not enough so that rodents can find harborage.

11-3. Heating and Ventilation Facilities. Most dry storage warehouses must be heated during cold seasons. An inspector must be observant since glass containers and liquid canned goods are particularly vulnerable to freezing. Some dry canned goods containers may withstand freezing; freezing, however, may cause undesirable changes in appearance in the food. Freezing can cause cans to burst. On the other hand, in warm weather, storage buildings must be adequately ventilated. This may be done with vents and windows; if necessary, exhaust fans may be used.

11-4. Insect and Rodent Control. The first step in insect and rodent control is to insure that no subsistence is infested with rodents, weevils, or other vermin. Products such as flour, dry beans, rice, raisins, macaroni, spaghetti, noodles, and cereals are particularly vulnerable to insect infestation. When performing an inspection, you should check the housekeeping procedures, the rodent proofing, the frequency of stock rotation, and evidence of insects and/or rodents. If insects and rodents are found, you should report this, along with your written recommendations about their control to the commissary officer.

11-5. Storage Charts and Markings. Charts showing the storage life of nonperishable subsistence are found in AFM 67-3, Storage and Materials Handling. Food containers without a packing date should be stamped to show the date that they are received. This will tell you how long the product has been in the warehouse and will serve as a means of controlling proper stock rotation.

11-6. Epidemic Spoilage. This is a spoilage which occurs when a can or cans in a stack of cases rupture and the contents leak on cases and cans which are stored below. The leakage spreads laterally and downward in a bell shape. Whenever epidemic spoilage is detected in a stack of subsistence cases, the spoiled cases and cans must be removed immediately so that further spoilage does not occur. The spoiled contents of ruptured cans will spoil other cans when they spill onto them.

11-7. General Dry Storage Points. Here are some general dry storage points that need your consideration as a food inspector: (a) Again, proper stock rotation, or FIFO (first in, first out), is a mandatory practice. It must be conscientiously checked for by inspectors and followed by warehouse personnel. (b) Don't stack too high. (c) Insects and rodents ruin the wholesomeness of dry foods in storage. (d) Check for ruptured cans and pyramids. (e) Check for mold. (f) Stack 6 to 8 inches away from wall. (g) Don't stack closer than 18 inches from ceiling. (h) Keep food stacks off floor. (i) Avoid stacking in front of windows or any other source of heat. (j) Close doors on wet days; open them in dry sunshiny weather. (k) Write to company and secure code of interpretation for date of their standard brands. (l) Destructive sampling is at commissary expense.

11-8. Controlled Atmosphere. Controlled atmosphere or C-A is a new storage practice in which oxygen in the atmosphere is replaced with inert gases. This reduces the rate of respiration of the item, thus decreasing degeneration. The practice is commonly used on fruits and vegetables although not all commodities will benefit from such storage techniques. The most successful C-A storage is for apples, and some varieties have been successfully stored for 7 to 8 months at 38°F.

12. INSPECTION OF CANNED GOODS

12-1. Since you normally do not perform prior to purchase inspections (class 3), you will not often follow a definite inspection plan for canned items as is specified in an individual contract. However, if you are performing a destination inspection (class 4), inspect a representative number on a statistical sampling basis. If more defectives are found than are allowed, notify DPSC (Defense Personnel Support Center). When inspecting canned goods on a class 5 inspection, remember that all invoices on these already Government-owned products normally will designate a condition code for the product. Three codes are used:

A, B, and C. Code A means prime quality; Code B means intermediate quality; and Code C means the product should be issued as soon as received and not held for any extended period of time. Products coded X are those that the DPSC had to ship to preclude a complete loss by the Government. The "during storage" inspection (class 9) is limited to insuring that the product is sound. We will discuss the problem from the angle of your examination of the individual can or the primary container; and, as necessary, its contents. To do this, we break the examination into two phases: spoilage when cans appear normal and spoilage when cans appear damaged because of a major or a minor defect.

12-2. Cans Appear Normal. In any open can inspection, usually used in conjunction with statistical sampling (covered at other places in this course), you may discover the following defects:

a. Soured contents (flat souring caused by thermophiles; contents develop excess acid without formation of gas).

b. Black contents (caused by reaction of sulfur and steel, or of steel with sulfur-producing bacteria).

c. Spangling (tin reacts with food components; appears as little dark blotches on inside of cans - does not adversely affect food. Often seen in a can of tomatoes.)

d. Texture, color, or taste of food is "off." (Evaporated milk must be rotated and periodically inverted to prevent settling and appearing grainy.)

e. Pinhole (small and at first invisible) - contents of can contaminated from outside. Gas escapes through pinhole, but not necessarily liquids. (Since pinholes usually occur around the inside groove of the upper seam, you can run a ballpoint pen firmly around the inside of the seam. When pinholes exist, the ballpoint will often puncture them or you should be able to feel a defective area.)

12-3. Defective Cans. A visual examination of a primary container includes type, style, size, condition, exterior coating, and labeling. Dents in cans are described by such terms as body dent, end seam dent, buckled seams, and paneling. (Paneling is caused by excessive vacuum.) You will especially consider major and minor defects. A major defect is one that could result in failure or materially reduce usability of the unit. A minor defect does not materially reduce the usability of the unit; it either limits its serviceability or is a departure from the established standard - a departure that has no bearing on the effective use of the unit.

12-4. If you perform a "during storage" inspection, the primary consideration is the condition of the product. The AMS Handbook, Exterior Condition of Filled Food Containers, U.S. Department of Agriculture, Agricultural Marketing Service, pictures both the upper and lower limits of major and minor can defects. For instance, any severe body dent (deep and sharp dents with sharp angles to the points) would be classified as a major can defect; so would a severe body dent involving an end seam with possible disruption of hermetic seal. A moderate body dent involving an end seam would be classified as a minor defect. Your supervisor will help you acquire skill in further identification of body dents in cans.

12-5. Distended Cans. There are other defects that relate to distended cans, all of which are normally classified as major. For instance, a FLIPPER is a can which has too little vacuum. The can appears normal until struck on a flat surface. The blow causes the opposite end to distend until forced back into position. The causes of this condition may be overfilling, insufficient exhaustion, or either chemical or bacterial action. SPRINGERS and SWELLERS are easier to locate and are predominantly caused by gas formation. A springer is a can with one end distended. If the distended end is forced in, the other end will distend. A sweller can has both ends distended. Varying degrees of internal pressure are denoted by such descriptive terms of visible-can defects as soft swell, hard swell, buckled, bucked, and peaked. You must determine the wholesomeness of canned products where any of the above defects are found as you inspect, and you must act according to regulations as to use or disposition of the affected cans. Some amplifications which will better explain the cause of swelling are as follows:

a. Hydrogen swells are caused by a reaction between acid foods and the metal can, releasing hydrogen gas.

b. Carbon dioxide swells are usually produced by microorganisms growing in the canned food. Ordinarily they are nonpathogenic, but occasionally, as in the case of botulism, they can be pathogenic in origin.

c. Carbon dioxide distension is a result of breakdown of the canned product. It is a very common occurrence in canned syrups and molasses. For some unknown reason, but perhaps due to the high carbodydrate content, these items break down and release carbon dioxide and cause cans to swell. This type of sweller is not harmful nor does it cause the product to be unacceptable.

d. Mechanical distension is where a severely damaged can (dented) has to give somewhere. So, a severe body dent on a can will cause a concomitant distension elsewhere, plus bulging the ends.

e. Filling errors are cans which have been slightly overfilled and/or which were not adequately preheated to evict the gas or were not adequately vacuumized.

f. Distension from differential altitude occurs occasionally when small, flat-type cans (sardine cans, especially) are filled at sea level and then shipped to a much higher altitude. This is not harmful as far as product quality goes.

12-6. Dried Products. Many products in the dry storage warehouse also require inspection. Examples are cereals, dried fruits, candies, etc. All previous precautionary statements regarding temperature, humidity, and stock rotation (especially) apply as firmly to these products as they do to those in cans. One of the greatest hazards to dried products is insect infestation.

13. OPERATIONAL RATIONS

13-1. Before we discuss the inspection of survival and inflight food packets as a special class of operational rations, let's look at the term "ration" and the uses of rations in general feeding situations, special feeding situations, survival feeding situations, and future feeding situations.

13-2. Terms Explained. A ration is the allowance of food prescribed by military regulation for one person for one day. A meal is a nutritionally balanced food unit consisting of one-third of the daily requirement of a ration. A combination of three meals constitutes a daily ration. A food packet is a short-term source of nourishment for use in special operational situations. It consists of prepared foods especially selected for maximum nutritional value, palatability, and stability, but the foods selected must be commensurate with requirements for minimum weight/cubage and other utility factors. A ration supplement is a collection of food, beverage, condiment, or comfort items intended to add to the minimum essentials of a specific operational food item. The supplement adds nutrition, palatability, and enhancement of morale.

13-3. General Feeding Situations. In this category, the food items are designed to satisfy feeding requirements of the large group, the small group, or the individual. Examples are the standard B ration, and the meal, combat, individual.

13-4. Standard B Ration. A field ration, except for mass feeding in areas where kitchen facilities (except refrigeration) are available, is known as a standard B ration. The ration is made up of nearly 100 nonperishable items. Some are canned; others, dehydrated. Hot meals supply about 3,800 calories per man per day, and menus are planned on a 15-day cycle.

13-5. Meal, Combat, Individual. One type of component that is designated to provide a nutritionally balanced meal rather than a ration is designated Meal, Combat, Individual. It replaced the Ration, Combat, Individual (c ration) which was used in World War II. This component may be used as an individual unit for a meal, or multiples of three meals may be used as a complete ration. Twelve different menus are included. Each meal furnishes about one-third of the minimum daily nutrient intake requirements.

13-6. Special Feeding Situations. Ration packets and supplements of the special feeding group are authorized for all services, but they are not routinely stocked. They would become available in the event of mobilization. They include items authorized for limited or special purpose use; an example is the Food Packet, Inflight (IF), Individual.

13-7. Food Packet, Inflight, Individual. A packet used to feed Armed Forces personnel while they are on flights which extend over one or more meal periods is designated as an individual inflight food packet. It consists mainly of canned items, meat, fruit, crackers, dessert, and an accessory packet, including beverages. Ten menus are available. The packet is packaged in a telescoping container which may be used as a tray and as a container for disposal.

13-8. Precooked Frozen Meals. Precooked frozen meals provide a highly acceptable hot meal for large, long-range aircraft in which several meals must be consumed. The meal is in an aluminum three-compartment tray with an aluminum foil cover crimped to the edges. It resembles commercial frozen TV dinners. It must be stored in freezers aboard aircraft at 0° F. or below. Aircraft in which these meals are consumed must have ovens which will heat frozen meals to an internal temperature of 160° F. Since the meal contains only 500 calories, it must be supplemented with beverage, dessert, salad and bread. To provide variety, eight menus have been selected.

13-9. Survival Feeding Situations. Two packets for Air Force survival feeding are the Food Packet, Survival, General Purpose, and the Food Packet, Abandon Aircraft, Individual.

13-10. Food Packet, Survival, General Purpose. A survival food packet is suitable for survival feeding under all types of environmental conditions, including conditions in which potable water is limited. Its protein content is controlled so that it conserves body water and yet insures maximum value from protein. Packaged in a 12-ounce rectangular can, the contents of this packet are: four bars (survival type) with six selections of fruit cake, chocolate fudge, cornflakes, rice-cornflakes, chicken-flavored potatoes, and potatoes with cheese; instant coffee; sugar; soup and gravy base, chicken-flavored; can opener, key-handle type taped to container; and directions.

13-11. Food Packet, Abandon Aircraft, Individual. An individual abandon aircraft packet is packaged in two cans, parts I and II. This packet is an extremely dense, high-fat, high-calorie item similar to pemmican which the American Indians used. Onion powder, chili seasoning and water may be added to it to make a gruel. The components of this packet are: meat-food product bars, cereal bars, chili seasoning powder, instant coffee, receipe sheet, fruit cake bars, onion powder, sugar tablets and instant tea.

13-12. Future Feeding Situations. Items designed for feeding situations in the future are Meal, Uncooked, 25-Man; Meal, Quick-Serve, 6-Man and 25-Man; Meal, Ready-to-Eat, Individua; and Food Packet, Individual, Combat.

13-13. A Meal, Uncooked, 25-Man will consist of nonperishable packaged food in a 25-man module, weigh less than 25 pounds, and consist mainly of dehydrated foods. It is designed for use in unit messing and will eventually replace the standard B ration.

13-14. A Meal, Quick Serve, 6-Man and 25-Man will consist of nonperishable, previously precooked, dehydrated components assembled in 6- and 25-man modules.

13-15. A Meal, Ready-to-Eat, Individual will consist of individual meals containing food components ready to eat where it is impossible to prepare a meal. The packaging material will be lightweight and the components will be eaten from the package. The meal will contain 1,200 calories.

13-16. A Food Packet, Individual, Combat will be small and light in weight, but it will have a high caloric content. It is designed for use during periods ranging from 2 to 10 days when no resupply is established or planned. Six food packets will be packaged in a bandolier, two packets being designated per man per day.

13-17. A Packet Subsistence, Longrange Patrol is designed for use in remote areas where resupply may be uncertain for as long as 10 days, where water is available, and where there is time to heat the water. There are eight designed menus, each one to furnish 1,000 calories.

13-18. An "M" packet will be the best packet for meeting immediate requirements until an individual combat packet is developed. It will furnish 1,200 calories and weigh about 18 ounces, consist of six menus, and be packaged in an aluminum foil laminate plastic bag.

13-19. Inspection of Survival and Inflight (IF) Food Packets. The inspection of the canned and frozen operational rations is so similar to other food inspections that it will not be discussed here. Your guidance for inspecting survival and IF packets is provided in AF Manual 163-3, Procedures for Operational Rations and Other Nonperishable Subsistence. As the title of this manual suggests, it may also be used as a guide in inspecting other operational rations. Mil Std-105 and Mil Std-109 should also be used as guides. To prepare you to inspect survival food packets, we shall discuss the forms used, deterioration and common deteriorative changes, and inspection procedures.

13-20. AF Form 2063. The form used in connection with the inspection of operational rations is AF Form 2063, Individual Colequap Report. This form is illustrated in AF Manual 163-3. One copy of the completed form should be retained in your files, one copy should be forwarded to the command veterinarian, and another copy sent to Air Force Services Offices, (AFLC) Attn: DPKFC, 2300 South 20th St, Philadelphia PA 19101.

13-21. Deterioration. High temperatures accelerate deterioration in food packets. It is estimated that the rate of deterioration doubles each time the temperature rises 18° F. Packets in aircraft are frequently subjected to extremely high and extremely low temperatures. Therefore, the age of a packet cannot be used as the only criterion for determining how often inspections should be conducted. However, inspections must be conducted periodically in order to determine the edibility of the food and the extent of deterioration. Six common deteriorative changes are browning; loss of acceptability; liquifaction; flavor, odor, and moisture transfers; damage to containers; and rusty cans.

13-22. Browning is a color change that occurs in foods containing sugars and amino acids (proteins). The brown color occurs must frequently in concentrated food bars. The color formation is not injurious to health, but it is an indicator of staleness and deterioration in flavor and acceptability. Browning is undesirable in food bars and fruit components and is considered a major defect. If the food has undergone a "loss of normal color," it is considered a Minor defect.

13-23. Loss of acceptability is a change in the clean, pleasant flavor and odor of food. Food gradually develops stale, unpleasing tastes and aromas. This occurs principally in abandon aircraft types of food packets, although it may occur in all of the food components in a packet or meal, including jelly bars. It becomes a Major A defect in food when it appears as a "strong metallic" or "strong rancid" flavor. If the food exhibits only a slight metallic or slight rancid flavor, it becomes a Major defect.

13-24. Liquefaction is that change where high-sugar foods become syrupy. This condition occurs most often in jelly bars. It is not harmful to health, but it reduces the eye appeal of food. Only when jelly bars are syrupy and moisten other components is liquefaction a Major defect.

13-25. Flavor, odor, and moisture transfer is a condition resulting in the mixing of flavors and odors of one or more of the food components with the others. Differences in moisture transfer occur because of differences in moisture content and hygroscopic attraction of the food components. This is considered a Minor defect when the component shows a "loss of true flavor" or "objectionable odor."

13-26. Damage that causes an opening at the seams of a container or elsewhere is a Major defect. Severe dents at seams or elsewhere and lesser dents and scratches are Minor defects.

13-27. Rust that penetrates or approaches complete penetration of a can is a Major defect. Other rust deposits are Minor defects.

13-28. Inspection procedures. All lots of rations must be inspected at least every 12 months. Packets removed from personnel equipment in aircraft may not form a homogeneous lot. They should be grouped into the most homogeneous lot possible. Of course the rations are inspected upon receipt, but other frequencies of inspection, such as every three or every six months, are required when previous inspection results indicate their necessity.

13-29 The steps involved in inspection are lot identification, selection of samples, determining the quality and disposition of the lot.

13-30. The first consideration in lot identification is establishing homogeneity. Homogeneity includes similar types of packets, similar dates of packaging, and similarity in handling and storage. Regarding similar dates of pack, if a part of one group of survival rations has been stored in a suitable warehouse while another portion from this same group was stored onboard aircraft, and they consist of less than 10 cases apiece, combine the two portions for inspection purposes. Separate them into individual lots only when one of the small lots contains a Major A defect or twice the number of defects of the other lot. Then the disposition of the two would naturally be handled separately. Likewise, where same packets have slightly different dates of pack (less than six months apart) and all were stored under like conditions, consider them as one lot and inspect them together. Regardless of its size, each lot must be sampled as a single lot. Samples should be selected at random to insure that they are representative of each lot.

13-31. A sample unit consists of one meal, packet, pack or accessory packet. Normally a meal or packet is packaged in an intermediate container, the contents of that intermediate container are the sample unit. Components from each menu must be equally represented in the sample.

13-32. Within AF Manual 163-3, the tables of examination applicable for inspection and components to be inspected under each table for each type of ration must be followed. Here is where the information is obtained to determine what inspection procedures are necessary for the type of ration to be examined.

13-33. When this information is obtained, each component of the ration must be inspected for defects listed in the appropriate tables. These defects are classified in accordance with Mil-Std-105, para 2.1, except that Major A defects are considered critical. When one or more Major A defect(s) are found in a sample unit the lot is considered unacceptable for human consumption and/or intended use.

13-34. In selection of samples, use double sampling plan in accordance with Mil-Std-105, para 10.1.2. The inspection severity used is normal inspection unless otherwise directed by the command veterinarian. Of course, sample units selected for inspection is done randomly with sample units for inspection under tables III, IV, and/or V being drawn from sample cases inspected under table II.

13-35. Up to this point, the information obtained on lot identification and sample selection should have been entered in the heading and Card 1 of AF Form 2063. This data for inspections of rations is recorded in accordance with instructions in the latest COLEQUAP handbook, as is subsequent data on inspection levels, sample units, and AQLs.

13-36. Card 2 of AF Form 2063, using table I of AFM 163-3, is filled in before the actual physical inspection of rations is performed. Table I - Sampling Plans and AQLs shows that applicable tables of examination are listed along with inspection levels, sample units, lot designations, and AQLs. It is of some importance to note that Acceptable Quality Levels (AQLs) are expressed in terms of defects per hundred units (DHU) for all tables. Using this table, assisted by the latest COLEQUAP handbook, and Mil-Std-105, Card 2 can be completed with sample sizes and accept numbers.

13-37. In determining the quality of the sample unit, each component is subject to examinations under the applicable tables as previously mentioned. When defects are noted, they are entered in Card 3 in the appropriate column(s) in ascending order. Should the table contain an alphabetical suffix, as do tables III and IV, it is entered to indicate what component contained the defect. Examples are provided in the latest COLEQUAP handbook. When the number of defects found necessitates inspection of the second set of samples, erase the first sample size and accept number, and enter the cumulative sample size and appropriate accept number in the columns provided in Card 2 of AF Form 2063. It should be noted that sample units for inspection under table IV are selected randomly from nondefective units inspected under table II and/or table III.

13-38. Upon completion of inspection of sample units for quality determinations it is necessary to assess the condition of the accessory packet or items. The following components of a meal or packet will be considered accessory items when not included in a separate package: sugar, salt, pepper, soup base, coffee, cocoa, cream, matches, cigarettes, napkins, chewing gum, interdental stimulators, spoon, fork, knife and can opener. There should be one accessory packet to every food packet or meal,when components are missing defects are assigned under table V.

13-39. The next step involves the interpretation of results to determine the quality and disposition of the lot. Table VI of AFM 163-3 gives disposition and reinspection criteria for operational rations inspected. A lot of product is considered acceptable for intended use, and normal frequency of inspection, when the number of defects found in each defect category examined is less than or equal: the first acceptance number using the sampling plan of table I of this manual and in Mil-Std-105, Table IIIA. A lot of product is considered unacceptable for intended use when any one or a combination of the following occur(s):

(1) One or more Major A defect(s) are found.

(2) When the cumulative number of defects found (second group of samples) in any Major B or Major defect category equals or exceeds the rejection number. A lot should be considered for immediate rotation when the number of defects for one or more Major B or Major defect categories found in the first sample equals or exceeds the rejection number.

13-40. Operational rations are to be inspected with the following frequency:

a. Upon initial receipt.

b. Yearly unless one or a combination of the following conditions exists (see Table VI):

(1) Every six months when the acceptance number of one or more minor defect categories (excluding marking defects) is exceeded in the first group of samples.

(2) Every three months when the number of defects for one or more Major B or Major defect categories is less than or equal to the acceptance number in the second group of samples.

13-41. When a lot of product is found to be unacceptable, disposition must be in accordance with AFM 145-1, paragraph 12-17 Include the disposition of the lot in the remarks section of AF Form 2063. Coordinate all inspection results and recommendations relative to storage condition and estimated storage life with the responsible property officer.

STUDY GUIDE AND WORKBOOK 3ABR90830-X-1

DEPARTMENT OF VETERINARY MEDICINE

VETERINARY SPECIALIST

FOOD PRESERVATION

August 1974

1-4

SCHOOL OF HEALTH CARE SCIENCES, USAF
SHEPPARD AIR FORCE BASE, TEXAS

Designed For ATC Course Use

DO NOT USE ON THE JOB

Department of Veterinary Medicine
School of Health Care Sciences, USAF
Sheppard Air Force Base, Texas 76311

SW 3ABR90830-X-1
August 1974

FOOD PRESERVATION

OBJECTIVES: To assist the student in understanding the more important aspects of food preservation and storage and to direct his attention to these aspects when carrying out his reading assignments.

PROCEDURE: This Study Guide/Workbook is divided into a series of exercises. Each exercise consists of a specific reading assignment in the Student Text and a series of questions. For most effective use, you should read the questions, then read the assigned sections of the Student Text and then fill in the answers to the questions.

Exercise A: Read Section 1 of the Student Text, then complete the following items.

1. When is food considered "spoiled?" Have you consumed any "spoiled foods" lately? If so, what? ____________________

2. Give examples of the following categories of foods:

   Semi-perishable: ____________________

   Perishable: ____________________

   Dry storage: ____________________

3. List three environmental factors which influence the degree and rapidity of food breakdown. ____________________

4. Pathogenic organisms will not readily grow in foods which have a moisture content below ____________ percent.

5. What type of microbial spoilage can be anticipated in foods with a pH range of 6.7 - 7.0? ____________________

   3.5 - 4.5? ____________________

   2.6 - 3.2? ____________________

6. What pH is needed in order to control the growth of pathogenic organisms? ____________________

Supersedes SW 3ABR90830-VIII-1, March 1973

7. Temperatures below ____________ °F will inhibit the growth of pathogens.

8. What is an enzyme? ____________

9. Enzymes remain active in foods until the moisture content is below ____________ percent.

10. a. What type of food is most subject to oxidation?

b. How can oxidation be partially controlled?

Exercise B: Read sections 2 and 3 of the Student Text, then complete the following items.

1. Describe the disadvantages of the "slow method" of freezing foods. ____________

2. What technique does the "quick freeze method" of freezing foods utilize to counteract the weaknesses of the "slow method" of freezing? ____________

3. a. What methods are commonly used in the commercial freezing of foods?

b. Describe the operations of each method?

4. How does temperature fluctuation cause deterioration in frozen foods?

5. What temperature is needed to stop the growth of most bacteria in frozen foods?

Is freezing bactericidal or bacteriostatic?

6. How does freezing affect the action of enzymes in frozen foods?

7. a. What is "freezer-burn"?

b. What causes "freezer-burn"?

c. How can "freezer-burn" be prevented?

8. What principle of food preservation is involved when foods are dried?

9. a. What disadvantages or detriments are associated with the drying method of food preservation? Explain.

b. How may darkening of fruits during drying be prevented?

10. a. List four types of foods that are frequently sun dried.

b. What is the major disadvantage of sun drying?

11. What method is most frequently used for drying potatoes and apples?

12. Tunnel drying is often used to dry ______ and ______.

13. Describe drum drying of foods.

14. What method of drying is best suited for foods that might be damaged by high processing temperatures and how is this process completed?

15. List the steps of freeze drying.

16. What important characteristic should the packaging material of freeze dried foods possess?

Exercise C: Read sections 4 and 12 of the Student Text, then complete the following items.

1. What is the purpose of "preheating" in the steps (unit operations) of canning (thermal processing) foods?

2. a. What is the usual retorting time and temperature for low acid foods?

b. What is the primary purpose of heat processing or retorting?

3. Why should cans be cooled immediately after they are removed from the retort?

4. Define "commercially sterile."

5. Why are enamels frequently placed on the inner surface of cans?

6. Why is C enamel used for canned corn?

7. a. What causes a "flipper"? How can "flippers" be detected?

   b. Distinguish between a "springer" and a "sweller."

8. What causes the following types of swells?

Hydrogen -

Carbon dioxide -

9. What is the cause of flat-sour spoilage?

10. How can you check for the presence of pinholes in cans?

11. Describe "spangling" in cans.

Exercise D: Read sections 5 and 6 of the Student Text, then complete the following items.

1. List five ways in which irradiation has been used to preserve foods.

2. What two types of radiation are commonly used in preserving food by irradiation?

3. In what foods has irradiation produced undesirable effects? How were these foods affected?

4. What chemical reactions are involved in the fermentation (pickling) of foods?

5. What acid is usually produced in foods during fermentation?

6. Name two foods produced by fermentation.

Exercise E: Read section 8 of the Student Text, then complete the following items.

1. What criteria are established by the Food and Drug Administration to certify/approve food additives for use?

2. a. What are the purposes of sugar when used as a food additive?

b. How is sugar used in the curing of meat? ______________________________

____

____

c. Under what conditions may the percentage of sugar be reduced when preserving fruits? ____

____

3. a. Why are acids utilized as food preservatives? ______________________

____

How is ascorbic acid used? ____

____

b. What acid is specifically effective against yeasts?

____

4. a. What effect does a 15 percent salt solution have on foods?

____

____

b. Why are nitrates and nitrites added to meats? ____________________________

____

____

____

5. a. What is the purpose of using antibiotics in food preservation? ____________

____

____

b. What two antibiotics have been used as additives in chicken and whole gutted fish and how have they been used? ______________________________________

____

____

6. a. Why are antioxidants added to foods? ______________________________

____

____

b. Rancidity is a common oxidative characteristic of ________________.

c. When is ascorbic acid frequently used as a food additive?

____

7. List four enzymes that are used as food additives.

____

____

____

____

8. a. How do artificial sweeteners differ from sugar? ________________

____

b. What is the action of monosodium glutamate? ________________

____

____

____

What is the cause of a foodborne illness known as "Chinese Restaurant Syndrome"?

____

____

____

9. Why is sodium sulfite classed as an illegal food additive? ________________

____

____

Exercise F: Read section 9 of the Student Text, then complete the following items.

1. Differentiate between packaging and packing. ________________

____

____

2. If waxed paper is waxed only on one side, it is considered to be (permeable) (impermeable) to water vapor. NOTE: Strike out the incorrect word.

3. When is aluminum foil deemed a good commercial wrapper? ________________

____

____

4. How does cellophane "work" as a flexible packaging material with meats?

5. What wrapping material is impervious to almost everything?______

6. Describe the characteristics of polyethylene and of polyvinyl chloride.

7. When is Mylar (Scotchpak) best used as a wrapping material?______

8. When may the consumer actually eat the packaging material?______

Exercise G: Read sections 10 and 11 of the Student Text, then complete the following items.

1. What foods are usually inspected in the cold storage facility?

2. What is the ideal temperature range for foods in the freezer storage room?

3. Temperature in the meat chill room should range from______ to______.

356

4. Why are dairy products and fresh fruits and vegetables not stored in the same room? ____________________

____

____

At what temperature should both rooms be? ____________________

____

5. a. Define the following:

Stacking - ____________________

____

Dunnage - ____________________

____

6. Describe proper storage practices for frozen foods received at temperatures below 20°F. ____________________

____

____

____

7. What do the initials "FIFO" represent? ____________________

____

8. AFM ____________ provides guidance for dry storage warehouse layout.

9. Dry storage items should be stacked ____________ to ____________ inches away from the wall and ____________ inches from the ceiling.

10. How should pallets be designed? ____________________

____

11. a. What type of products is particularly vulnerable to insect infestation?

____

b. What should you inspect with regard to insect and rodent control in a medical evaluation of a warehouse? ____________________

____

____

12. What undesirable changes may result if canned foods are frozen? ________

13. What action should be taken when epidemic spoilage is detected in a stack of subsistence cases? ________

Exercise H: Read Chapters 5, 6 and 12 of AFM 145-1, then complete the following items.

1. What foods are best stored at each of the following humidities?

90 - 95% ________

80 - 90% ________

70 - 75% ________

2. When should temperatures be recorded if automatic temperature recording devices are not provided in a cold storage facility? ________

Who has the responsibility for recording temperatures? ________

3. How should the termination of the maximum possible storage period for a food product be computed? ________

4. Distinguish between "forced issue" and "forced substitution." ________

5. While it is impossible to determine the condition of the contents of a can without examining the contents, what method(s) may an inspector use to determine the edibility of the contents? ________

6. What is the primary cause of mold growth on meats?____________________

____

____

____

7. What security precautions should be taken in dry storage facilities?

____

____

____

____

8. In general, what is "keeping time"?__________________________

____

9. On what form are emergency subsistence issues recorded?_______________

10. What are WRMs? ______________________________________

359

STUDENT TEXT

3ABR90830-XI-1,
30BR9921-1-IV-1

Technical Training

Veterinary Specialist
Veterinarian

ANIMAL SERVICE

October 1975

1-4

SCHOOL OF HEALTH CARE SCIENCES, USAF
Department of Veterinary Medicine
Sheppard Air Force Base, Texas 76311

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ST 3ABR90830-XI-1, 3OBR9921-1-IV-1
October 1975

ANIMAL SERVICE

OBJECTIVES

The information provided will enable you to:

a. Identify the responsibilities of the Veterinary Service in relation to government owned animals and control of zoonotic diseases in the military community.

b. Prepare appropriate documents pertinent to the operation of a base animal service program.

c. Assist the veterinarian in subprofessional care of animals including the basic epizotiology of zoonotic and nonzoonotic diseases; animal restraint; surgery assistance; as well as some diagnostic procedures.

INTRODUCTION

1. An important part of the mission of the Veterinary Service is performed in the Veterinary Clinic providing health care to animals. With regard to animals, your responsibility involves

a. Protecting the health and efficiency of government-owned animals, and

b. Protecting the health of personnel by controlling zoonotic diseases, that is, animal diseases that are transmissible to man.

2. The role of the Air Force Veterinary Service has expanded somewhat over the years, giving us a broader range of activities in the area of pet care. We are no longer restricted to treating animals strictly for the purpose of controlling zoonotic diseases. However keep in mind that the care we deliver to pets must still be on a limited, outpatient basis.

3. In this chapter, we will cover several aspects of operating the Veterinary Clinic. We will look into the funding of this facility, some necessary housekeeping practices, proper procurement and maintenance of drugs and supplies, as well as some information in small animal surgery, animal restraint, first aid, and some diagnostic procedures. We will also study the documentation used in operating the clinic, including that necessary for animal bite cases, quarantines, and related health examinations.

4. Aside from information related directly to the operation of the clinic, this chapter contains material on some of the common disorders of pets, including the more common communicable diseases, both zoonotic and nonzoonotic, as well as some noncommunicable disorders.

This supersedes ST 3ABR90830-XI-1/3OBR9921-1-IV-1, September 1974.

INFORMATION

MILITARY WORKING DOGS

1. The German Shepherd

a. The German Shepherd is the only breed of dog used for military duty by the Air Force. This breed was selected over all others because they are readily available and because of their breed characteristics. These characteristics include the ability to adapt to different climatic conditions; a long and tireless gait; strength, courage and agility; and, a natural distrust of strange persons or situations. The ability to adapt to various climatic conditions can be attributed to their double haircoat. The outer coat is long, coarse and somewhat water-resistant. The under coat is soft and furry, and its thickness varies with the climate; that is, it grows thicker in cold climates.

b. Not every German Shepherd has the physical or temperamental characteristics required of a good working dog. Therefore, rigid specifications must be met by each dog before it is accepted for training. In addition to meeting specifications concerning general appearance, temperament, and physical soundness, a dog must be in a good state of health as determined by a veterinarian.

2. Specifications

a. To be acceptable for procurement, a dog must be a good representative of the German Shepherd breed. The specified characteristics of general appearance include

- Either sex (females must be spayed; castrated males or those with undescended testicles are acceptable)
- At least 23 inches in height at the withers
- At least 60 pounds in weight
- Between 12 and 36 months of age
- Must be a sturdy, compact, working type that reveals evidence of power, endurance, and energy
- Any color except white
- Coat should be lustrous (outer coat dense; under coat density variable with the season or geographical region)
- Strong teeth with no more than four missing, none of which may be a canine tooth (overshot or undershot jaw is not acceptable)

b. The temperament of an acceptable dog must show evidence of typical German Shepherd characteristics as defined by the breed standards. Desirable features are

- Aggressiveness (neither cowardly nor mean; but irritatable when teased, as indicated by such actions as snarling, barking, and raising the hackles)
- Alertness (clear eyes and suspicious attitude)
- Responsiveness
- Vigor
- Steadiness

c. Physical examinations to determine the state of health of dogs that are candidates for procurement must be done by a licensed veterinarian. A dog that is in poor physical condition or is afflicted with certain diseases is unacceptable. Therefore, you should be aware of the major disqualifying factors.

- A contagious disease or any condition rendering the animal unsuitable for immediate training
- Heartworm infection (as determined by the Knott's concentration test)
- Defect in hearing, vision, or the sense of smell
- Bone or joint disease (including hip or elbow dysplasia)

When the owner of a dog wants to donate or sell it to the U.S. Government, certain procedures must be followed.

3. Procurement Procedures. Inquiries concerning furnishing dogs for military use should be made directly to: DOD Dog Center (SAAMA), Lackland Air Force Base, Texas 78236. This office furnishes all of the necessary application forms and questionnaires to be completed by the owners. Also included is a preservice physical examination form to be completed by the veterinarian.

a. The application forms must include certificates of vaccination, issued by the veterinarian, against canine distemper, infectious canine hepatitis, leptospirosis, and rabies. Vaccination against canine distemper, infectious canine hepatitis, and leptospirosis must have been within 6 months of shipment into the state of Texas. When the complete forms and questionnaires are received from an owner, the Military Dog Acceptance Board determines whether the dog might be acceptable. If there is a possibility of acceptance, the Working Dog Procurement Center at Lackland is notified to send to the owner a shipping crate with shipping instructions.

b. The owner is instructed to ship the dog, via air freight or Railway Express, at government expense. The shipping crate protects and secures a dog while it is in transit and provides a trough in the door for water and feed.

c. At Lackland, the dog is removed from the shipping crate and immediately equipped with a leather collar. It is then watered, checked for any ill effects resulting from the trip, and assigned to a kennel.

During the next 2 or 3 weeks, the animal is given a complete veterinary medical examination and a series of tests which determine its suitability. During this period, the government reserves the right to reject an unsuitable dog.

d. A veterinary member of the Military Dog Acceptance Board ensures that each dog receives a veterinary medical examination to determine if it meets the required specifications. This examination includes a blood test for evidence of heartworm infection and a pelvic X-ray (radiograph) to determine whether or not the dog has a disqualifying degree of hip dysplasia. A dog that does not pass the examination is declared unfit for military duty and is returned to the owner or disposed of in accordance with AFR 125-9, USAF Military Working Dog Program.

e. An animal that is accepted for the Military Working Dog Program is marked for identification. It is tattooed with Preston brand numbers on the inside of the left ear. In cases of heavy ear pigmentation, the tattoo may be applied on the inner side of the left flank. These numbers consist of four units, one of which is a letter, such as A001, 00C3, or 004D.

4. Training. All USAF military working dogs are trained at the Military Working Dog Branch, Lackland Air Force Base, Texas. Dogs to be used by the Air Force are trained to perform as "patrol dogs," highly trained animals that can be utilized for a great variety of functions. Another type of military working dog that is in use is the "sentry dog." It has been in use for a longer period of time than the patrol dog, but it is not as highly trained and therefore cannot be used for as many purposes. It is quite possible that you will be in contact with both sentry and patrol dogs; therefore, it would be of some help to you to be familiar with their capabilities and utilization.

5. Capabilities and Utilization. We will discuss briefly the capabilities and utilization of military working dogs. If you are interested in a description more detailed than is presented here, read AFM 125-5, USAF Military Working Dog Program, volumes 1 and 2.

a. The capabilities of the German Shepherd are indeed impressive. Besides their great stamina and strength, they have a very high IQ, some experts believe it equals that of a 7 year old human. They also possess powerful senses that are an asset to them while performing their duties as military working dogs. For instance, their sense of smell far surpasses that of man. If a dog wishes to examine an object, he moves downwind to take advantage of his keenest sense - smell. A dog's hearing ability is about 20 times better than that of man. He can detect sounds above and below the pitch a human is capable of hearing. With the exception of his ability to detect movement, a dog's vision cannot be compared favorably to that of the normal human. He can detect a moving object when it is moved slightly, and he will respond to the movement.

b. It is because of the German Shepherd's capabilities that they can be trained and utilized in the manner now practiced by the military. Let's look at the utilization of both sentry and patrol dogs.

(1) Sentry Dog. The sentry dog team is used to increase security of such areas as distant perimeter points, ammunition dumps, warehouse areas and isolated radar sites. When on post, a sentry dog's primary function is that of a detection and warning device. This function has been performed when the dog detects and alerts his handler to the presence of the intruder. The secondary function of the sentry dog is to pursue, attack, and hold any intruder who attempts to evade or escape from apprehension. The sentry dog team works well, primarily against sabateur and espionage agents; it also provides base security forces with an early detection capability which would have been almost impossible otherwise.

(2) Patrol Dog. The patrol dog was developed because the sentry dogs lacked the versatility required for complete effectiveness in the combat environment of Southeast Asia.

(a) Patrol dogs are trained to

- Detect the presence of an intruding force and be capable of alerting or observing without being detected by the enemy force.
- Assist security forces by scouting and tracking.
- Work safely in close proximity to friendly forces on strike teams, reconnaissance, and ambush patrols without becoming distracted or agitated.
- Accept a new handler with reduced training time.

(b) It was learned that the same skills and versatility the dogs acquired in training for an effective combat role could be used effectively to protect resources, property, and personnel in all aspects of security and law enforcement. These uses include

- Area and perimeter security and defense
- Mobile security patrols

- Listening posts, reconnaisance and combat patrols
- Escorting and safeguarding funds
- Riot and crowd control
- Drug Detection

6. Medical Care of Working Dogs

a. The Veterinary Service is charged with the responsibility of providing government working dogs with complete medical care. This includes all aspects of maintaining the health of the animals. Before we discuss some specific responsibilities, let's look at some general precautions that MUST be taken in order to treat working dogs safely and effectively.

(1) Some people believe that military dogs, whether on a leash or loose, are walking safety hazards. Safety-conscious personnel can prevent military dogs from committing unsafe acts and thereby disprove such beliefs. Begin your safety practices the instant you first are in contact with any dogs. A few of the basic safety precautions include:

- Never turn your back on a dog.
- Never kick, slap, or hit a dog.
- Do not speak or move in a threatening manner around a strange dog.
- Avoid sudden movements around dogs.
- Recognize signs which indicate that a dog is preparing to bite. Some of these signs are growling, curling lips or baring teeth, staring or standing perfectly still, and raised hackles on the back of the neck.

(2) The opportunity for violation of good safety practices exists when a dog is presented to the veterinary officer for examination of treatment. Bear in mind that the dog is in strange surroundings among strange people for treatment that is unusual and sometimes painful. This is an abnormal situation for the dog, and its behavior may not be what you would expect. Therefore, always be alert and prepared to control the animal while medical care is being provided.

(3) Because of the flow of dog traffic at the clinic, the nearness between dogs presents a safety problem. A dog must always be kept at a proper and safe distance from other dogs and people. Before entering or leaving a doorway or passageway with a dog, a habit should be made of giving a loud, clear, vocal warning. "Dog coming through!" This will prevent walking the dog into someone. Also, it is best that the dog be kept on a short leash, and that its actions be watched constantly.

(4) If possible, the handler should accompany the dog to the clinic. When the dog must be restrained for examination or treatment, the handler can best do it. When the handler is not present, you can generally calm the dog by soothing it with kind words and actions. When the dog is handled properly, you can better administer good care and treatment.

b. Now you have a general idea of some of the safety precautions necessary to prevent injury to yourself, or others, while assisting with the treatment or examination of working dogs. Now, let's look at our specific responsibilities with regard to medical care.

(1) Daily Sick Call. There will be a sick call for working dogs held on a daily basis at some regular time. In this way the handlers can bring their dogs to the veterinarian as soon as any signs or symptoms of illness or injury appear.

(2) Immunizations. Working dogs are immunized routinely for rabies, canine distemper, leptospirosis, and infectious canine hepatitis.

(3) Routine Physical Exams

(a) Every 6 months - or more frequently if deemed necessary by the veterinarian. This physical must include the Knott's Test for heartworm.

(b) At the time of procurement

(c) Before departure to a new base

(d) Upon arrival at a new assignment

(4) Kennel Inspections. The kennels are inspected to ensure that adequate sanitation measures are being followed. The results of the inspections are recorded on an AF Form 1556, Animal Facility Sanitation Report. (Figure 1.)

(5) Zoonoses Control. The veterinarian takes any precautions necessary to control zoonotic disorders. This includes, but is not limited to, immunizing for leptospirosis and rabies, treating for internal and external parasites, and treating for a variety of bacterial and fungal infections of the skin, eyes, and ears.

(6) Maintaining Medical Records. The veterinarian is responsible for maintaining the complete medical records for all the working dogs at the installation to which he is assigned. You will need to be very familiar with the forms included in these records because you will assist the veterinarian with them; therefore, we will cover them in detail in a later section.

(7) Instruction of handlers in the medical aspects of handling the working dogs. It is recommended that the veterinarian or you, his assistant, give routine training sessions to dog handlers on subjects such as proper grooming and bathing of the dogs, first aid procedures, daily health inspections, feeding, or any other topic that would help the handler take better care of his animal. We will look at first aid in a later section, but let's discuss some important aspects of grooming, feeding, and inspecting dogs at this time.

(a) Grooming. A working dog should be groomed on a daily basis, usually near the end of the day. First, the handler should give it a brisk rubdown with the fingertips. Any dead skin, hair, or dirt can be loosened and brought to the surface by rubbing against the lay of the hair. This rubdown also massages the skin. The rubdown should be followed by a thorough, but gentle brushing against the lay to remove the loosened skin, hair, and dirt. Brushing also stimulates the secretion of skin oils, reduces flea and louse infections, and gives a dog a feeling of well-being. Next brush the coat with the lay and return the hair to its natural position. Finally, rub the coat with the lay, using the palms of the hands, to help distribute the oils, and to give the coat a glossy appearance. Occasionally comb the dog's coat. Combing should be limited in winter so as to avoid tearing out the warm under coat.

(b) Bathing. It is seldom necessary to bathe working dogs that are well groomed. They should not be bathed, except to remove dirt, grease, or unpleasant odors that cannot be removed by regular brushing.

(c) Daily Health Inspections. The working dogs should be inspected by their handlers as they are groomed. Handlers should be instructed to examine the body areas listed below and look for the signs and symptoms of the various disorders that are discussed under each.

1. The Eyes. The eyes are one of the four parts on the head of an animal that should be examined. Normally, a dog's eyes are bright and clear, and the color of the surrounding membranes is a healthy pink. The small wedge-shaped membrane,

known as the nictitating membrane or third eyelid, should cover only a very small part of the inner cornea of the eye.

2. The handler should look for any of the following symptoms of illness or injury; a reddish or yellowish discoloration of the membranes and whites of the eyes, paleness of the membrane of the eyes, the presence of whitish or yellowish discharge from the eyes, and cloudiness or other discolorations of the clear portion (cornea) of the eye. Other symptoms to watch for are puffiness of the lids, lids held partially or completely closed, or nictitating membranes that cover more than the normal part of the cornea. Be careful not to injure the dog's eyes while examining them.

3. The Nose. This is a second part on a dog's head which will exhibit symptoms of illness. The black pod at the end of the nose is usually shiny and moist, but may be dry and dull when certain illnesses are present. Other symptoms to look for are: the presence of a watery, yellowish, or red-tinged discharge from, or caked around, the nose openings; sneezing; snorting; and pawing at the nose with the feet. The dog's nose should not be probed with any object under any circumstances.

4. The Ears. The third inspection point on the head of a dog is the ears. The erect external portion of the ear is called the ear flap. Leading downward from the base of the ear flap is the ear canal. The portion of the canal which can be seen with the naked eye is known as the vertical canal. The deeper portion, which cannot be seen, is the horizontal canal. Small quantities of brownish wax are frequently seen in the vertical canal and are normal.

5. The presence of a reddish discoloration, swelling, or large amounts of discharge in the ear canal are abnormal. Other symptoms include a foul odor from the canals, shaking of the head, holding the ear flap down, holding the head to one side, twitching the ear, scratching or pawing at the ear, and evidence of pain when the ear is touched. Dirt and wax can be removed from the inner part of the ear flap, but complete cleaning of the ears should be done only by a veterinarian. A handler should never probe into the ear canal with any object.

6. The Mouth. The dog's mouth is the fourth place on its head where numerous things should be checked. Normally, the gums and inner aspect of the lips are a healthy pink, and the teeth are firm and shining white in color. Symptoms of illness include paleness of the gums and membranes, redness and bleeding of the gums, sores of various types, persistent drooling, bloody saliva, and a foul breath. Other conditions to notice are: loose and broken teeth, tartar accumulations on the teeth, foreign objects lodged between the teeth, and any gagging by the animal or any pawing at its mouth.

7. The Skin and Hair Coat. This is subject to changes in appearance with changes in climate or season. For instance, shedding of the hair is more noticeable and is normal in hot climates or seasons. However, the following conditions are indications of skin trouble: reddening, scabbing, moist discharges, scratching, shedding that is abnormal for the season or climate, loss of hair in one or more spots, dryness, and loss of pliability. Also, handlers should watch for the presence of fleas, ticks, and lice.

8. The Feet. If a working dog is to carry out its duties effectively, its feet must be given proper care and attention. Therefore, the feet should be inspected for foreign objects that may be caught in the pads or hair, for cuts and bruises, and for abrasion of the pads. As mentioned previously when discussing grooming, the length of the dewclaws should be especially noted, as well as the condition of the other nails. Also, any lameness of the dog should be considered because this may be a symptom of a foot problem.

9. The Genitals. The handlers should examine their dog's genitals for abnormal conditions. With male dogs, a small amount of greenish-yellow discharge normally exudes from the prepuce (the skin fold around the penis). Large or increased amounts of discharge are an indication of trouble. Likewise, swelling, reddening, or scabbing of the scrotum (skin pouch surrounding the testicles) are abnormal conditions that should not be overlooked. If the dog is a female, the handler should look for reddening of the vulva (the external opening of the genital tract) or the skin in the area. Any discharge from the vulva is an abnormal symptom.

10. The final inspection location to be mentioned is the anal region. The anus forms the external opening from the dog's rectum, at the end of the digestive tract where excretion occurs. The anal glands, which are located on either side of the rectum near the anus, are a frequent source of trouble. The handler should look for any swelling and reddening of the skin in the area or of the anus itself. At times the glands may become filled with secretion, causing the animal to bite at the area or to slide along the ground in a sitting position.

(d) Feeding. A proper diet is necessary to keep a working dog in good health. A good diet will satisfy the dog's energy requirements and provide all of the essential components of a balanced ration. The dog's food must originate in clean, sanitary plants and must be manufactured, packaged, stored, and transported in conformance with good commercial practices as determined by the USAF Veterinary Service. Presently, the diet procured and fed military working dogs is packed in 25 pound containers and is called Maximum Stress Diet (MSD). This diet contains approximately 2,500 calories per pound. Special diets may be fed to individual dogs with certain types of illness or in certain geographical locations when the veterinarian indicates that a standard diet is not adequate.

7. Military Working Dog's Medical Records

a. The proper maintenance of the permanent military working dog field record file is the concern of handlers, trainers, supervisors, and veterinary personnel. You must ensure that these records give the complete story of each dog's medical history throughout its service as a military dog. When each dog is purchased, the procurement center initiates the permanent field record file. The permanent field record is composed of two parts: administrative records and medical records. This record file accompanies each dog on every transfer and is kept current by personnel of the organization to which the dog is assigned and by the base veterinarian's office. All entries in the records must be either typed or written neatly in ink.

b. All information concerning a dog's medical history or background must be entered on one or another of approximately 12 different forms that are included in the dog's record. Only veterinary personnel are authorized to make entries on these medical forms. If it becomes necessary that a civilian veterinarian give treatment to a military dog, advise him of the entries that he must make in the medical records.

(1) Two forms, the DD Form 722 and the AF Form 788, are used as the military dog's medical records folder. The words "Military Working Dog Health Record" and the animal's name and tattoo number will be placed on this form. All other medical record forms will be filed in this folder. In addition, all photographs, correspondence, statement and certificates relative to the identification, health, or death of a military dog are considered permanent health records and must be filed in the medical records folder.

(2) DD Form 1742 (Figure 2.), Military Dog Clinical Record, is the basic military dog medical record. Both the front and reverse sides of the form are used. Enter all veterinary medical care provided for a military dog, including routine physical examinations, chronologically on this form. These entries must be signed and initialed by a veterinarian or veterinary technician. As each DD Form 1742 becomes completely filled, transfer it to the inner side of the front cover of the medical records folder.

(3) On a monthly basis only, record the weight of a military dog on SF 512, Clinical Record - Plotting Chart. This does not mean that the dog should be weighed only once a month. To the contrary, it should be weighed at least once each week. If the animal is suffering from an illness, weigh and record the weight of the animal even more frequently. A knowledge of weight gains or losses can be important in the detection of disease or in the planning of a proper diet for each dog.

(4) DD Form 1741 (Figure 3.), Military Dog Immunization Record, is one of the most important medical records because every immunization that a military dog receives is recorded on it. The initial immunizations are given to the dog at the procurement center. The protection is continued with immunizations which are given, and recorded, periodically as required. The veterinarian who administers or authorizes the immunization signs the form beside each entry, in the column marked "Veterinarian." The front side of DD Form 1741 is used to record immunizations for rabies and leptospirosis. Use the reverse side to similarly record immunizations for canine distemper and infectious canine hepatitis.

(5) DD Form 1626 (Figure 4.), Veterinary Necropsy Report, is used to record the results of the necropsy which is required when any military dog dies or is euthanized. However, at procurement locations, necropsies are required only on dogs that die or are euthanized for causes which are medical in nature.

(6) Whenever a military dog is shipped interstate or to a foreign country, a DD Form 1744 (Figure 5.), Veterinary Health Certificate, must be prepared by the Veterinary Officer. Enter on the form such information as the name of the shipper, the destination of the animal, personal data about the animal, immunization data, and certification data regarding the presence or absence of symptoms relative to communicable diseases. A copy of all health certificates must be inserted as a permanent part of the dog's medical record.

(7) Several standard medical forms are routinely used to record military dog medical clinical information. Each time one of these forms is used, be sure that the dog's name and tattoo number are entered on the form. SF 514, Clinical - Laboratory Report, is a form on which we report laboratory procedures. Attach the individual reports to SF 545 (Figure 6.), in the medical record. The following are common laboratory forms that will be used:

(a) SF 550, Urinalysis

(b) SF 549, Hematology

(c) SF 551, Serology

(d) SF 552, Parasitology

(e) SF 553, Microbiology I (Bacteriology)

(f) SF 557, Miscellaneous

(8) Other standard forms that are provided for recording clinical information include:

(a) SF 515, Clinical Record - Tissue Examination

(b) SF 516, Clinical Record - Operation Report

(c) SF 519, Clinical Record - Radiographic Reports

When surgical specimens are submitted for pathological examination, complete the pertinent portions of an SF 515, and furnish it with the material to be examined. When the pathologist's report is received, file the SF 515 in the medical record. Complete an SF 516 for all operations performed on a military dog. An SF 519 is completed for all x-rays taken of a military dog. File these individual reports in medical record folder.

(9) Occasionally, it is necessary to perform euthanasia on a military dog because of its temperament, old age, or for medical reasons. Before the chief of security police can have the veterinarian perform euthanasia on a military dog, he must obtain written approval from the base commander. The base commander's approval is granted in an indorsement to a letter recommending euthanasia. When the reason for euthanasia is medical in nature, the letter to the base commander is supported by a statement from the veterinarian. The letter must identify the animal by name and tattoo number and clearly specify the exact reason for euthanasia.

NOTE: The veterinarian may perform euthanasia without prior written approval of the commander in an emergency situation when delay would cause the animal undue suffering. In such an instance the veterinarian must write a letter through the chief of security police to the commander stating the necessity for such action. A copy of all correspondence relative to euthanasia becomes a permanent part of the dog's medical record.

(10) Any x-rays taken of a military dog become a permanent part of his medical records, but they are not kept in the field record file. File them in special envelopes and place them in a flat position in a protected repository. X-ray envelopes, which may be requisitioned through normal supply channels, preserve the quality of the x-ray film. Each x-ray film must bear the name of the dog, its tattoo number, and the date on which the x-ray was taken. Forward a dog's x-rays with other field records when the dog is reassigned or when the records are sent to the Central Records Repository upon the death of the animal. Always mail x-rays in special mailing envelopes which have cardboard inserts to prevent bending.

(11) Arrange the medical records in the medical records folder in the following order:

(a) Left Side (The first forms to be on top of the opened folder and the others in sequence as listed.)

- Completed DD Form 1742, Military Dog Clinical Record
- DD Forms 1829, Record of Military Dog Physical Examination
- Wilford Hall Medical Center Forms (WHH Form 124), Military Working Dog Procurement Physical Examination.

(b) Right Side (The first form to be on top of the opened folder and the others in sequence as listed.)

- Current DD Form 1742, Military Dog Clinical Record
- SF 512, Clinical Record - Plotting Chart (used to record weights)
- DD Form 1741, Military Dog Immunization Record
- SF 545, Laboratory Report Display
- SF 519, Radiographic Reports
- Wilford Hall Medical Center Forms (WHH Form 210), Clinical Records - Dental

- SF 516, Operation Report
- SF 515, Tissue Examination
- Miscellaneous Correspondence
- DD Forms 1744, Veterinary Health Certificate
- Veterinary Examination of Prospective Military Dog with Photographs (stapled to lower right hand corner of DD Form 722)

(c) After death or euthanasia the following should be added to the right side with the first form on top and the others in sequence as listed.

- DD Form 1743, Death Certificate of Military Dog
- DD Form 1626, Veterinary Necropsy Report
- Correspondence relative to death or euthanasia

RESEARCH SUPPORT

1. Mission

a. Not every veterinary specialist in the Air Force is a food inspector; many are assigned to research facilities where their duties pertain to many of the aspects of supporting research that utilizes experimental animals. These veterinary specialists deal with the job of providing researchers with healthy animals and maintaining the animals during the course of the research and at times actually assisting with surgical and other aspects of project. The overall mission of the Veterinary Service, with regard to research, is to support the biomedical and veterinary aspects of Air Force research, development, test and evaluation.

b. Let's look at some of the areas of Air Force research in which animals are used.

(1) Crew Environment. In this area, animals are used to test the effects of such factors as high altitude and chemical polutants on aircraft crews. The many hazardous aspects of the aircrew environment are thoroughly investigated by using animals in lieu of man, unnecessary risk to life and well being can be avoided.

(2) Radiation Hazards. Air Force researchers are continually trying to gain more information on radiation's effects on man. There are many sources of radiation that serve as hazards to personnel; two common examples are radar and lazars.

(3) Mechanical Forces. There are many mechanical forces that have adverse effects on man, especially when subjected to the rigors of flight, be it in a cargo plane or lunar module landing on the moon. The Air Force's research projects include testing the effects of such factors as noise, vibrations, impact and G-forces on aerospace crew members and personnel. Through continued research using animal subjects, it is hoped that the hazards presented by these physical forces can be identified and then prevented by developing protective measures.

(4) Medical Studies. There are countless research programs underway in which new medical procedures are being developed to save and improve human lives. Already new surgical procedures have been developed to graft and transplant organs. Countless drugs and therapeutic techniques for treating a variety of disorders have been developed. This area of research is extremely necessary, and is very rewarding to all concerned.

2. Responsibilities and Duties

a. The responsibilities of the members of the veterinary field, when involved in research support, fall into three main categories:

- Procurement of research animals
- Disease control
- Colony management

b. Duties. Let's look at some of the specific tasks of veterinary specialists, and that might therefore become part of your job should you be assigned to a research facility.

(1) You could be required to assist in purchasing experimental animals. This could entail accompanying shipments of animals and providing them with the care needed to keep them healthly during the trip.

(2) Under the supervision and instruction of the veterinary officer in charge, you will perform routine clinical laboratory examinations which may include skin scrapings for skin parasites, blood counts and blood examinations, fecal examinations for parasites, and urine analysis.

(3) Infected animals, newborn animals, and animals received into a colony must be kept in a quarantine area to insure that infection is not spread to other animals. It might be your responsibility to manage the quarantine facility and make routine observations of the animals for signs of illness.

(4) Another duty might be administering diagnostic tests and immunizations. Diagnostic tests, such as the tuberculin tests of monkeys, are administered routinely. Examples of immunizations which are given include those for canine distemper, hepatitis, rabies, leptospirosis and feline distemper. The veterinary officer in charge must prescribe the techniques, agents and dosages.

(5) Animals must be observed daily for signs of illness and injury. Their quarters must be frequently checked for cleanliness and sanitation. AF Form 1556, Animal Facility Sanitation Report, will be used when making inspections to insure that all aspects of sanitation are checked and recorded. A copy of this report is submitted with any other findings to your veterinary officer.

(6) Another common duty of the veterinary specialist is assisting in surgery. This necessitates familiarity with the proper restraint procedures; of course, they will vary depending on the type of animal being restrained. Unless the animal is properly restrained, it is very difficult, if not impossible, to administer the anesthetic. In preparing the animal for surgery, the veterinary officer or medical researcher will inform you of the area which is to be shaved and disinfected, the pre-anesthetic agent to use, the instruments, equipment, and linen required, and the bandaging required after surgery. We will discuss some of these areas in detail in a later section of this text.

(7) Whenever a laboratory animal dies or is sacrificed for a reason, a necropsy is usually performed. Veterinary Necropsy Procedures, by Gleiser and Jones, is an excellent reference for many animal necropsies. It may be necessary for you to learn special techniques for necropsies from your veterinary officer. All findings in a necropsy will be observed by a veterinary officer and recorded on a necropsy form (DD Form 1626).

372

(8) Finally, let's talk about some specific duties you might be required to perform in the area of colony management. The veterinary officer in charge has overall responsibility for the management of the animal colony. However, many management and operational tasks are performed by the animal technician. Records of the number of each species on hand and of the number due to arrive and their quarantine status must be current and readily available at all times. Other tasks of the technician include assigning animals to holding facilities for individual research units as needed, supervising the feeding, watering, and general care of animals, overseeing tattooing and identification procedures, preparing purchase requests for procurement, requisitioning supplies and equipment, and maintaining treatment records.

3. USAF Research Facilities. There are several Air Force research facilities that use experimental animals in their mission objectives. All of these have veterinary specialists assigned to assist in the areas already discussed.

a. USAF School of Aerospace Medicine (SAM), Brooks AFB TX. The Veterinary Sciences Division maintains a large diversified species research animal colony in support of the multiple mission requirements of USAF (SAM). Some of the SAM research mission activities supported by the Division are experimental surgery, aerospace feeding, aerospace environmental programs, physiological chemistry, and radiological effects. In addition, the Veterinary Sciences Division is responsible for the course content and course supervisory functions for the Laboratory Animal Medicine Residency, 50AY9946G, the Veterinary Surgery Residency, 50AY9946A, and the Animal Technician Course, AZY90671, and participates in other aspects of the school education program as required.

b. 6570th Aerospace Medical Research Laboratories (AMRL), Wright-Patterson AFB OH. Animals are used in this laboratory for studies of biomedical criteria for aerospace flight, low-spin velocities of long duration, vibration and impact, biothermal problems, respiration, and toxicology. This unit has a large vivarium.

c. Biophysics Division, Air Force Weapons Laboratory (AFWL), Kirtland AFB NM. This laboratory has more large animals than any of the other laboratories. Projects include personnel hazards associated with ambient space radiation and investigations of space radiation, whole body radiation, and partial body radiation.

d. Aerospace Medical Laboratory (AML), Wilford Hall USAF Hospital, Lackland AFB TX. Projects at this facility include using animals in support of research in Air Force clinical medicine, kidney and heart transplants, and cardiorespiratory resuscitation studies.

THE VETERINARY SMALL ANIMAL CLINIC

1. It is not the intention of the Air Force to provide complete medical care to pets. However, pet owners in the military will be afforded limited outpatient service for their dogs and cats to fulfill two purposes: first, to prevent pets from becoming health problems; and second, to prevent animal population control problems in the community. The former refers, of course, to zoonoses control and involves such procedures as immunizing for diseases, treating for a variety of bacterial and fungal infections of the skin, eyes, and ears. The Air Force Veterinary Service is authorized to aid in the control of animal populations by providing low cost neutering surgery for the pets of military personnel. Female dogs and cats undergo a bilateral ovariohysterectomy, commonly called a "spay," which is the removal of both ovaries and the uterus. Male pets are castrated by surgically removing the testes.

2. The drugs and supplies required for immunizing and treating pets may be purchased from commercial sources through the Central Base Fund (CBF) or from base medical supply, using nonappropriated funds. No materials purchased with appropriated funds will be used on privately owned pets; these materials are reserved for use on government-owned

400

animals, primarily patrol dogs. Let's take a look at the Clinic Fund and at the Central Base Fund and learn how they are used by the Veterinary Service.

3. Veterinary Clinic Fund.

a. Being a minor revenue producing fund, a veterinary clinic fund must be administered, audited, and inspected in accordance with AFR 34-3, Basic Responsibilities, Policies and Practices. If your office has a need for a clinic fund and there is no record of an authorization, you must request written approval of the Base Commander.

b. When authorization for a clinic fund is received, prepare a letter to the Base Commander proposing the fees to be charged. Figure 7 provides an example of such a letter. These fees must include the cost of all materials purchased plus a small markup (usually about 15 percent). The proceeds from this fund are deposited in the central base fund and any net profits are available for use by the central base fund council. When the proposed fee schedule has been approved by the Base Commander, it should be posted where it is clearly visible to everyone who uses the clinic's services.

c. You must keep a running account of all money received and paid out on AF Form 1555, Central Base Fund Veterinary Receipts, as shown in figure 8. Certification of ownership, by signature on the form, is required of each person presenting a pet for treatment. All persons not in uniform must show proper identification. This is the verification that the owner is a member of the military services and is entitled to veterinary clinic privileges.

4. Clinic Operation. If you are to be helpful in a clinic, there are numerous tasks that you must learn. The personal contacts involved make it extremely desirable that you develop courteous methods of working with those who use the clinic's services. All telephone calls must be handled courteously. You must be extremely careful in giving information and answering questions over the telephone, however, because the results of a misunderstanding can be very serious. In most cases, those who request guidance for treating animals by telephone should be tactfully advised to bring their animals to the clinic for observation by the veterinarian at a specified hour. It is certainly difficult, if not impossible, for the veterinarian to accurately determine symptoms when he does not see the animal. Also, the identity of callers cannot be positively determined until they come to the clinic.

a. AF Form 1554, Animal Clinical Record. This form is used to record all clinical treatments and immunizations of privately owned animals at the base zoonoses control clinic. A separate AF Form 1554 will be maintained for each animal seen in the clinic and should be given to the animal's owner on transfer or separation. If it is retained in the clinic, it must be held for 18 months after the last treatment entry. After the animal dies, the record should be destroyed. Entries on the animal clinical record (as shown in figure 9) should be either typed or printed to ensure that they are legible. Entries should be made only by veterinary service personnel.

b. In conducting an active zoonotic disease control program, as prescribed in AFR 163-4, Prevention and Control of Communicable Diseases of Animals, control measures will include immunization of susceptible animals. Do not let the decrease (in recent years) of rabies in pet animals cause you to lose your concern about rabies control. The danger from this disease still exists. The decreased incidence of this dreaded disease in pets exists only as a result of very extensive preventive efforts over a long period of time.

c. DD Form 793, Rabies Vaccination Certificate. In addition to recording all immunizations of privately owned animals on the animal clinic record, a DD Form 793, Rabies Vaccination Certificate (see figure 10), will also be prepared for each animal immunized against rabies. The original copy will be furnished to the owner, a duplicate will be retained for filing, and additional copies may be made, as required. The veterinarian's file copy is destroyed when superseded by a new certificate, or when the animal has departed the installation or has died.

d. Watch all animals closely while they are in the clinic. This is particularly important when two or more are present. If they are not carefully watched and restrained, a fight can easily develop. In addition to the danger of injury to the animals and the personnel in the area, emotional stress is placed on the owners. Since people are emotionally affected by the way their pets are handled, you should always be kind and thoughtful toward the owners and their animals.

e. Housekeeping duties.

(1) Special attention must be given to maintaining cleanliness of the animal clinic and the surrounding area. Excited animals frequently urinate and defecate as well as vomit in waiting rooms and outside areas. In these instances, you should clean the area immediately. The clinic examining table, medicine cabinet, and all examining instruments should always be clean.

(2) To prevent the spread of infection, you must be sure that adequate sterilization and disinfection procedures are practiced at all times. All surgical instruments, syringes, and needles should be sterile at the time of use. By now you probably realize that zoonoses control clinics use single-use needles and syringes that are presterilized and ready to use. However, under certain conditions you may be required to sterilize syringes, needles, and instruments, so you should know the correct procedures. Autoclaving is the most desirable means; it should be carried out for 15 minutes at 250°F and 15 pounds per square inch pressure. Chemical sterilization is not recommended for syringes and needles since trace amounts of the agent may kill the viruses in a live virus vaccine. Surgical instruments should be autoclaved as described above or by using chemical sterilizing agents. You should clean the instruments and wrap them in surgery packs. The packs may also include, depending on their intended use, gauze pads (sponges), suture material, suturing needles, towels, drapes, surgical gloves, caps, masks, and smocks. If your surgery packs are not used within two weeks, they should be reautoclaved.

(3) Syringes and needles used in the zoonoses control clinic must be properly disposed of after use. They must be destroyed (not thrown into the trash) because of the possibility of someone handling them and becoming ill by contacting the materials in or on them, and to prevent someone using them for unauthorized purposes. There are machines made specifically for destroying used hypodermic syringes and needles; they will incinerate, melt, shred, or sufficiently mutilate them to prevent their reuse. If the veterinary office does not have adequate facilities to properly dispose of syringes and needles, use the facilities provided by the parent medical unit.

f. Drugs and supplies. Each veterinary activity maintains certain drugs and supplies which are necessary for treating pets in the clinic. These materials are purchased with nonappropriated funds and are therefore accountable to CBF. You must conduct a monthly inventory of all CBF drugs and supplies in accordance with the requirements established by AFR 34-3 , Basic Responsibilities, Policies and Practices.

g. Laboratory procedures. Another of your duties will be assisting the veterinarian in performing diagnostic laboratory procedures. Many disorders of dogs and cats can be diagnosed only with the use of specific laboratory tests. However, you will probably be limited to assisting in diagnosing those disorders caused by parasites. These tests include microscopic examination of feces for the presence of internal parasite eggs; ear swabbing, and skin scraping for detecting the presence of external parasites; and examination of blood samples for evidence of heartworms. Later in this chapter we will cover some of the many parasites that can attack pets and the types of tests that are used for their diagnosis.

5. Health Examinations and Quarantine. In the interest of public health there are certain occasions on which pets must be examined by a veterinarian. Let's look into these responsibilities and the necessary documentation.

a. Animal bites. Whenever an animal bite incident is reported, the attending medical officer at the medical treatment facility initiates AF Form 1551, Animal Bite Report (see figure 11), for a human patient who has been bitten by an animal. He should complete the form as fully as possible, numbering it serially with others for control purposes. When treatment is completed, he attaches a copy to the patient's file, gives a copy to the Base Veterinarian, and sends another to the Director of Base Medical Services for informations, guidance, and necessary action. Upon receiving this report, the Base Veterinarian completes the required portions of two copies of AF Form 1552, Rabies Quarantine Notification, as shown in Figure 12. The Rabies Quarantine Notification form is used to notify the animal owner or responsible public health official that the incident occurred. Your responsibilities will vary, depending on whether the animal is maintained on or off base.

(1) Healthy pets (living on base) that are involved in a bite incident are often quarantined in the home of the owner for 10 days. The owner is given strict instructions notify the Base Veterinarian if the pet begins to behave in any unusual manner. During the quarantine period and at the end of the period, the animal will have to be examined by the veterinarian. The AF Form 1552 will be maintained by your office until such time as the pet is released from quarantine.

(2) Animals living off base are under the control of local civilian quarantine authorities. These agencies should be notified immediately by phone when a bite occurs and a copy of the AF Form 1552 should be forwarded to them. You should maintain liaison with the quarantine authorities during the quarantine period. At the end of the 10-14 days quarantine, the completed AF Form 1552 should be forwarded to the DBMS or his designated representative for inclusion in the patient's medical records.

(3) Animals that live on base that are bitten by an animal with rabies or suspected of having rabies will be handled as follows:

(a) Quarantined for 60, preferably 90 days if currently immunized.

(b) Quarantined for 180 days if not possessing a current rabies immunization or destroyed and animal will be examined for evidence of rabies.

b. An additional need for quarantine or isolation facilities occurs when animals are off-loaded from aircraft at bases where the quarantine services of the United States Public Health Service or of the USDA are not available. The animals will be inspected, handled, and isolated in accordance with the general policies of AFR 161-4, Medical and Agricultural Foreign and Domestic Quarantine Regulations for Vessels, Aircraft, and Other Transport of the Armed Forces. All members of the veterinary service should become familiar with this regulation.

c. Health examinations and certificates. When an animal is to be transported from one state or country to another, the regulatory agencies usually require that the animal be examined by a veterinarian. This examination can be performed by a military veterinarian, who will record the condition of the animal on DD Form 1744, Veterinary Health Certificate. Copies of this certificate should be furnished to the owner and to disease regulatory officials. Veterinary health certificates used in conducting base zoonoses control clinics will be destroyed after 6 months, whereas those used in the military working dog program become a permanent part of the dog's medical record.

d. U.S. and foreign quarantine rules. As a veterinary specialist, many people will be contacting you concerning shipment of their pets. It may be for a vacation or a PCS move to another state or to a foreign country. Direct them to check with the state agriculture or health department for requirements relative to travel within the United States. If traveling to a foreign country, they should consult the nearest consulate or the country's embassy in Washington, DC, for the latest requirements. Airlines often have information on quarantine rules and can answer questions concerning shipping container construction, feeding while traveling, and even information on kennels and their rates en route and at destination.

SMALL ANIMAL RESTRAINT

1. There will be many times when it is necessary for you to restrain a dog or cat while assisting the veterinarian in the clinic. You will have to subdue animals while the veterinarian is treating them, giving injections, or performing examinations. At these times the pet experiences apprehension, discomfort, and sometimes, pain. It is placed on a cold, slippery table and strangers stick him with needles or pinch, pull and poke him. The whole situation is enough to make even a gentle pet bite, scratch, or leap off of the table. You or the veterinarian might suffer a bite or scratch; or the pet might be injured when jumping off the table. A dog or cat leaping from a slippery table can easily land off balance and break a bone. So, by practicing proper restraint you will be preventing injury to yourself, the veterinarian and the pet.

2. When you restrain an animal, for whatever purpose, bear in mind that there are many good techniques; the method you use depends on your personal preference and experience. The method used, however, must be compatible with two factors.

a. First, the technique must be compatible with the procedure being performed by the veterinarian. If he is going to look into the dog's ears, you can't restrain it in such a way as to make the dog's head inaccessable. This warning may seem obvious to you, but is a common error of inexperienced assistants.

b. The second factor to consider when choosing a restraint technique is the viciousness of the pet. A dog that wags his tail and comes to you willingly will more than likely require very little restraint. Too vigorous restraint of such animals will only hinder rather than help. However, an obviously hostile dog that growls, bares its teeth, or snaps must be handled with caution, using more cautious restraint.

3. Restraint of Dogs. Before we describe some techniques for restraining dogs that you might want to try, let's discuss some things you should know about approaching the animal.

a. First, you should know that successful restraint depends a lot on your ability to realize what is going on in the animal's mind. This may be a combination of bewilderment and apprehension, often with discomfort or pain. You must therefore develop a little knowledge of canine psychology; you need to be able to recognize, by the animal's attitude, just what it is likely to do. Look for signs of displeasure. We already discussed some pretty obvious ones - snarling, barking, snapping and baring of the teeth; those are sure signs that a dog will try to bite you. A not so obvious warning sign is when a dog just stares at you with no real outward signs of pleasure or displeasure. He is usually undecided on what to make of the situation, but with little or no provocation such a dog will often lash out in the only way he knows - with his teeth.

b. Second, don't make sudden movements or loud noises. This will only add to the dog's confusion and apprehension. Most of the time a dog will either try to bite you or jump off the table; either way, the animal will be very difficult to handle, much less treat or examine.

c. Talk to the animal to reassure it. Whether a dog is overly hostile, or acts very friendly towards you, you should talk to it to soothe it and reassure it. A vicious dog can sometimes be "won over" by gently talking to it; also, this will almost always insure that a friendly dog will stay that way; even when you put it on the treatment table and subject it to some discomfort or pain.

4. Now, let's discuss some methods of restraint that work well for dogs.

a. Once on the table, (if at all possible let the owner place the dog on the table), hold the dog loosely by the collar until the veterinarian examines or treats it. You can simplify your job by allowing the dog to assume the position he chooses, unless of course, the examination or treatment requires a special position.

b. Usually you can hold a dog for an injection by simply grasping the loose skin at the back of the neck with one hand and lightly "cupping" the lower jaw with the other. This immobilizes the head but does not place so much restraint on the dog that he panics.

c. Another way to restrain a dog for an injection is to slip one arm under his chin, holding the neck as loosely as practical in the crook of the arm. The other arm is passed over the animal to either rest on the opposite side, hold a leg or wrap around the chest or abdomen. This hold can be tightened if a dog suddenly panics and fights to get loose.

d. There are many more methods that can be used to restrain dogs, but the teaching of these methods is best done in the classroom with demonstrations and slide presentations.

e. Whenever there is any suspicion that a dog might bite, a muzzle or mouth tie could be applied. This will protect you and the veterinarian from injury. To make a mouth tie, use a strip of 2 or 3 inch wide gauze about 2 feet long. Make a loop and slip it over the mouth so that it rests back away from the nose. Tie an overhand knot in the loop (up on top) and bring the gauze down and tie another overhand knot. Be sure to tie simple overhand knots, or some other easily removed knots, in case the animal starts to choke or vomit. Complete the mouth tie by passing the ends of the gauze beneath the ears and tying them over the base of the skull.

5. Restraint of Cats.

a. For the most part, your approach to restraining cats should be quite different from your approach to restraining dogs. A good generalization concerning the restraint of cats is that the least amount of restraint possible is usually best. Cats are usually very apprehensive of their surroundings. Entering the veterinary clinic and being in close contact with dogs and other cats often adds to their overall displeasure. The final "afront" to the cat is when it is grabbed and forcefully held down while a complete stranger pulls at its ears, shines a bright light into its eyes, crams a pill down its throat and then sticks a needle into its leg. It's no wonder that cats often go into a rage when subjected to the rigors of the veterinarian's examination table. However, you would be amazed at how much a cat can put up with if, instead of forcefully grasping the cat and smashing it onto the table, you hold it by the scruff of the neck and gently scratch it between the ears. You will find that your job is much simpler when you use slight restraint instead of harsh restraint.

b. Unfortunately, slight restraint will not work on all cats. Therefore, it is extremely necessary for you to be familiar with good techniques for restraining hostile cats, for they can inflict painful wounds with their teeth and claws. We will describe some methods of restraining cats here, but for the most part this area, like dog restraint, is best dealt with in the classroom with slides and demonstrations.

(1) First, a description of a method that allows for subcutaneous, intramuscular, and intravenous injections, as well as the examination of much of the cat's body. Confine the rear legs by grasping them in one hand, with your index finger between the legs at the hocks. With your other hand, grasp the cat's skin at the base of the skull and exert downward pressure if necessary. In this position the cat cannot bite or scratch you.

(2) For unusually hostile cats, the use of restraint devices can be very useful.

(a) Nets. A small but strong net (like a fisherman's landing net) can be used for removing animals from cages as well as facilitating immobilizing it for injections or examinations.

(b) Wrap-up devices. Towels and sacks are useful for completely wrapping a cat to immobilize it. Its legs and feet are tucked into the wrapping; then, whatever part of the body is desired for examination or injection can be pulled out or exposed by peeling back a small part of the wrapping. Of course, this has very limited use because you don't have access to the middle regions of the cat's body.

SMALL ANIMAL SURGERY

1. The surgical procedures performed by Air Force veterinarians are primarily those which neuter the animal for the purpose of controlling pet populations. For females, this involves removing the ovaries and uterus, an operation known as an ovoriohysterectomy (commonly called a spay). Castration of male animals is accomplished by surgically removing the testicles.

2. Presurgical arrangements. Before you schedule a privately owned pet for surgery, there is some information you must get from the owner and some important instructions you must give to them.

a. Find out if there is any condition of the pet which contraindicates surgery; that is, a condition that would make it inadvisable, for some reasons of health, to perform surgery. Some examples of contraindications are: (1) old age, (2) heart or lung condition, and (3) existing infections or diseases.

b. You must be sure to set up the time of surgery, discuss the changes, and inform the owners of the risk involved whenever an animal is anesthetized for surgery. The "anesthetic risk" is that animals react differently to anesthetic agents and it is possible that an animal will die from it.

c. Finally, you must tell the owner to withhold food and water from the animal for 12-18 hours prior to the time of surgery. This ensures the stomach and bowel will be empty. This removes the possibility of an animal defecating or vomiting after he is anesthetized. It is extremely important that owners follow these directions; it is not uncommon for an animal in an unconscious state to choke to death on its vomitus.

3. Surgical Equipment and Instrument Preparation. There are a variety of materials required for performing surgery. First there are the instruments; the types and number of each will be decided by the veterinarian. Next, you must have gloves, towels and drapes. You may be asked to include surgical masks, caps and smocks. Also, you will need some sponges, (gauze pads) 2" x 2" or larger, needles and suture material. The arrangement and wrapping of these materials into surgical packs can vary, for each veterinarian usually has his or her own way of preparing them. Therefore, you will be instructed by the veterinarian as to the method he prefers. Regardless of the method of preparation, you should sterilize them in an autoclave at 250°F for 15 minutes and 15 lbs. pressure.

4. Anesthesia. Anesthesia is used to remove the sensation of pain. This is sometimes accompanied by unconsciousness or semiconsciousness. It is used to aid in restraining animals as well as to perform surgery or other painful procedures. Let's discuss the different types of anesthesia and their uses.

a. Topical. This type of anesthesia has extremely limited use. It is applied to the skin or mucous membranes, and will only anesthetize the surface. It is useful in procedures involving the cornea of the eye or oral mucosa. It is available in spray, ointment or liquid form.

b. Local. This type of anesthetic is used to anesthetize of "deaden" a small area of the body for minor surgery. The agent is injected into the area surrounding the site, and it infiltrates within the tissues and desensitizes the nerves.

c. Regional. This type of anesthetic is used to "deaden" a whole region of the body by desensitizing the main nerve entering that region. For instance, by injecting an anesthetic agent around the main nerve at the shoulder of a dog, the whole fore limb will be desensitized. Another example would be injecting the agent into the spinal column at the lower back. This will desensitize both hind legs and the pelvis region.

d. General Anesthesia. This type is used whenever major surgery is to be performed, or when unconsciousness is required for a procedure to be performed; for example, radiographing a dog or scaling (cleaning) its teeth.

(1) There are two types of general anesthetics, those that are injected and those that are inhaled. You will probably have more experience with the injectable variety since very few Air Force clinics have the equipment necessary to administer gas anesthetics.

(2) General anesthetics depress the central nervous system. The nervous system is depressed in a progressive manner, whereby the animal becomes unconscious, then goes "deeper" into anesthesia. General anesthesia can be divided into various levels, called stages, in which certain characteristic behavioral and physiological changes will occur. By familiarizing yourself with the stages and their characteristics, you will be able to monitor a dog that is "under" a general anesthetic and therefore aid the veterinarian in maintaining the animal at the desired level of anesthesia.

(3) Let's look at and discuss the levels of general anesthesia.

I. Stimulant Stage

II. Anesthetic Stage

Plane 1

Plane 2

Plane 3

Plane 4

III. Paralytic Stage

(a) Stimulant stage is a transitory period of excitement characterized by:

- vigorous struggling
- dilation of pupils
- increased respiration
- rapid pulse
- increased saliva and tears

(b) Anesthetic stage

1. An animal enters this stage after the stimulant stage. It is characterized by the following:

- pupils contract
- muscles are relaxed
- respirations are slow and of the abdominal type
- heart is slightly, if at all, accelerated
- pulse is regular and strong
- complete suspension of all sensations. This stage may be maintained for 2-4 hours, provided anesthetic is cautiously applied. If too much is given, the animal passes into the next stage.

2. This stage, in which surgery is performed, is divided into four planes. Planes one and two are called light anesthesia and planes three and four are considered deep anesthesia. Most veterinarians maintain an animal in the deep anesthesia planes while performing surgery. This can be accomplished by monitoring two reflexes. The first is the pedal reflex, a jerking of the leg when the toes or pads of the feet are pinched. This reflex disappears between planes two and three. The other reflex is the palpebral reflex, a flinching of the eye when the inside "corner" (palpe [illegible]) of the eye is touched. This reflex disappears if the animal goes "deeper" than plane four. Therefore, if the pedal reflex is gone and the palpebral reflex is still present, the animal is in the deep anesthetic planes three and four.

(c) Paralytic stage. In this stage the animal is in danger of dying; therefore, avoid letting it go this "deep." The paralytic stage is characterized by the following:

- gradual slowing of the heart
- pulse becomes slow and weak
- respiration becomes shallower, labored and will eventually cease
- death - usually due to respiratory failure

4. Treatment of overdose. When an animal has been overdosed with a general anesthetic, it is in great danger of dying from respiratory and cardiac failure. Therefore, emergency action should be aimed primarily at those two areas. Artificial respiration and external heart massage will aid in regaining proper heart and respiratory action. Also, there are many drugs that counteract the anesthetic; the veterinarian will inject the drug appropriate for the particular anesthetic agent being used.

FIRST AID

1. It is quite possible that an animal in need of immediate medical attention will be brought into the clinic at a time when the veterinarian is not present. Often immediate care must be rendered in order to save the animal's life, or to prevent his condition from worsening. This immediate, possibly life-saving care is what we call first aid.

2. When a dog has been injured, or is suffering from any condition which requires emergency action, he is usually in pain and distress. He may struggle violently and even attempt to bite. It is important to remember that the first thing you should do is to restrain the animal properly before attempting to administer first aid treatment. Proper restraint can mean muzzling the animal with a mouth tie or just holding the dog in such a manner as to prevent his biting you.

3. If an animal has been badly injured, these might be the steps to take in administering first aid:

a. Restrain the animal to protect yourself from injury.

b. Maintain an open airway. Use common sense here; don't muzzle a dog that has breathing difficulty, restrain it by some other means.

c. Control hemorrhage.

d. Keep the animal warm, but not hot. Watch for shock.

e. Cover any wounds with a clean bandage.

4. Now let's look at some specific situations that would require first aid treatment and discuss what action might be taken.

a. Hemorrhage.

(1) Capillary - usually a pressure bandage is all that is required to stop bleeding from the capillaries.

(2) Venous - the use of a pressure bandage will generally stop bleeding from a vein. This type of bleeding is characterized by dark blood that flows steadily from the wound.

(3) Arterial - This type is characterized by bright red blood "pumping" or "spurting" from the wound. A pressure bandage will sometimes stop the flow of blood, but often a tourniquet will be necessary. Apply the tourniquet (a shoelace, belt, or a length of cord) with just enough pressure to control the bleeding.

b. Respiratory failure. An animal may stop breathing because it has swallowed its tongue, has a foreign object in its mouth or throat, has been partially drowned or has suffered extreme trauma such as being hit by an automobile or receiving an electrical shock. After checking the mouth for blockage or a swallowed tongue, you might have to perform artificial respiration by applying alternate pressure to the rib cage.

c. Shock. Shock is a condition characterized by a decrease of blood circulation. It can result from any severe trauma, such as a blow to a vital organ, loss of blood, or exposure to extreme cold. Therefore, whenever you are administering first aid to an animal, look for signs of shock.

(1) The animal may look like it is asleep, or it may be semiconscious. This general appearance will be accompanied by the following:

(a) pale membranes in eyes and mouth

(b) rapid, shallow breathing

(c) cold extremities

(d) possible glassiness of the eyes

(2) Shock is a very serious condition! An animal in shock may die if not properly treated. Situate the animal with its head slightly lower than its body. Keep it warm, but not hot. Avoid excitement and keep the animal quiet. Do not give alcohol as a stimulant.

d. Fractures. The fractures that occur the most in dogs and cats are those of bones in the legs. Apply a splint whenever possible. The leg must be fastened above and below the fracture. If a dislocation or a fracture is close to the body you will probably not be able to apply a splint. Pad the leg and transport the dog in a manner that will cause as little discomfort as possible to the animal.

e. Foreign objects in the mouth. A dog will occasionally get a stick or other object lodged in his mouth or throat. Symptoms are coughing, gagging, difficulty in breathing or swallowing, pawing at the mouth, and drooling saliva. If the animal is having a great deal of difficulty breathing and you can see the object, attempt to remove it. Do not confuse these symptoms with symptoms of dumb rabies.

f. Poisoning. Symptoms of poisoning are variable. Because of the uncertainty of the type of poisonous substance the dog may have eaten, it is generally not wise to give first aid treatment for poisoning. The dog should be kept quiet and warm until the veterinarian arrives.

g. Overheating. The symptoms are weakness, unsteady gait, vomiting, labored breathing, convulsions, and collapse with a body temperature of 105° or higher. First aid treatment is to lower the body temperature as rapidly as possible by whatever means you have available. This consists of moving the animal to the nearest shade and running or sponging cold water over the head, body, and legs. If a stream or body of water is nearby, the animal should be immersed. If ice is available, it should be massaged over the body and legs. If the animal must be moved more than a few yards, he should be carried or transported in a vehicle.

ZOONOTIC DISEASES

1. A zoonotic disease is an animal disease that can be transmitted to man. Of the approximately 200 known animal diseases, more than 80 are classified as zoonoses. Even though all of these zoonotic diseases are important to man, we will discuss only two, rabies and leptospirosis. Our discussion will be limited to these diseases because they are carried by dogs and cats, and it is quite possible that your work will bring you into contact with them.

a. Rabies. The virus that causes rabies exists in the saliva of affected animals. This infectious saliva is introduced into the human body through the animal's bite or scratch wounds. The virus may be present in the saliva of infected animals for a few days before the onset of symptoms. Therefore, animals may transmit the disease before they exhibit signs of being infected. The dog is the animal that has been chiefly responsible for spreading rabies to man because of its close association with humans. However, rabies is not uncommon in felines, and a rabid cat is certainly capable of inflicting severe lacerations with its claws and teeth. Wild animals, such as skunks, wolves, foxes, and coyotes, can also transmit the disease to people. These uncontrolled wild animals lose their natural fear of man when infected with rabies, and will often venture into thickly populated areas. Infected bats can also transmit rabies. These animals exist in large numbers in colonies and have been captured while attacking humans or animals.

(1) Rabies is a fatal disease which may affect any warm-blooded animal. Once the virus has been deposited on or near a nerve of a susceptible animal, it moves up the nervous system until it reaches the brain, where it attacks and destroys the nerve cells. The virus then travels to the salivary glands, where the transmission of the disease to other animals or man is made possible. The incubation period may vary from 12 days to 1 year, but it is usually less than 3 months. After the onset of symptoms, the disease will progress through two of three possible phases.

(a) The first symptom of rabies in any animal may be a slight change in its behavior. Most animals in the prodromal (beginning) stage of the disease are nervous and excitable. Dogs in this stage may seem overly friendly, and are attracted to groups of people. Although they do not attack, they resent being handled and will bite those who attempt to pet or handle them. The first signs of changes in behavior that occur are difficult to distinguish from digestive disorders, injuries, foreign objects in the mouth, poisonings, or early stages of many other infectious diseases. The prodromal phase may last up to 72 hrs;then, the disease takes either the furious or the dumb (paralytic) form.

(b) Most people think of rabies only as in the furious form. This second phase of the disease represents the so-called "mad dog" condition. An animal which has the furious form of rabies becomes a vicious, biting terror, completely without fear. It will bit and attack anything that moves in its path. An animal victim of this phase of the disease will show extreme alertness and excitement, and will exhibit widely dilated pupils. Salivation may or may not be evident. In this stage, dogs frequently travel great distances. The furious phase rarely lasts longer than a day or two and, in some instances, may occur for very short period or maybe not at all.

(c) In the dumb form of rabies, the animal shows no excitement whatsoever and is very sluggish and morose. Saliva usually drools from its mouth because its throat muscles are paralyzed. In many cases the animal's lower jaw hangs open. Because of the open jaw and the salivation, the owner may suspect that a bone or other foreign object is lodged in the animal's throat. Searching for these objects with bare hands is a frequent reaction with concerned owners. Although the animals are not vicious and usually are not able to bite, this search is a dangerous practice because the saliva is a certain source of infection. An animal with dumb rabies will usually live for only a day or two before becoming completely paralyzed.

(2) Although the usual symptoms may be sufficient to cause suspicion, the animal should be referred to a veterinarian for positive diagnosis. This diagnosis involves sending the head of the suspect animal to a laboratory. At the laboratory, tissue from the brain is examined microscopically, usually by two techniques. The first and oldest technique is examination for Negri bodies which appear in a specific location in the brain in terminal stages of the disease and which strain with certain dyes. The other technique is to demonstrate fluorescent antibodies which, when present, will appear with a characteristic glow. If both of the techniques are negative, it usually means rabies is not present, but does not entirely exclude the possibility of rabies infection.

(3) As an added precaution, mice are usually inoculated with a suspension of brain tissue from the suspect animal and are observed for 30 days. If rabies virus is present, the mice will die with rabies within this period, and Negri bodies and fluorescent areas can be found on stains of their brain tissue. If at all possible, rabies suspects should be captured and confined and the disease allowed to progress until the animal dies. Killing animals too soon may reduce the accuracy of laboratory diagnosis, since Negri body development is directly related to the length of clinical illness of rabies.

(4) When a dog has bitten someone or is suspected of having rabies, it should be quarantined for 10 days. Because of the rapid progress that rabies makes, signs will probably be observable in the animal within a day or two. If symptoms of rabies start to show during the quarantine period, there is usually sufficient time to start prophylactic treatment of the person that was bitten.

(5) Prevention of rabies is accomplished by immunization of susceptible hosts, primarily dogs and cats. Air Force Regulation 163-4, Prevention and Control of Communicable Diseases of Animals, dictates the types of vaccines that should be used.

b. Leptospirosis.

(1) Leptospirosis in dogs is an acute, infectious disease which is transmissible to man. A spirochete organism of high motility (spontaneous movement) is the cause of the disease. This bacteria may exist for many months on dead or decaying organic material in rivers, lakes, ponds, or other bodies of water. Garbage, cesspools, and fish ponds may become contaminated with urine from infected animals and serve as a bearer of the disease. Infection usually results from entry of the organism through the mucous membranes of the nose or mouth. Less frequently, the organism enters through skin abrasions or through the genitalia during breeding activity. Leprospirosis is more prevalent in male dogs because they smell and lick areas possibly contaminated by urination of other dogs more frequently than do females.

(2) The disease may attack suddenly after an incubation period of 5 to 15 days, with initial temperatures reaching 103°F. to 105°F. Weakness, loss of appetite, vomiting, and mild congestion are among the early signs. Because these symptoms are not definitive, clinical diagnosis in this state is extremely difficult. Other symptoms which may follow the initial infection are a decrease in temperature, hemorrhages of the skin and mucous membranes, jaundice, and muscular soreness. The disease establishes itself primarily in the liver and kidneys, causing partial or complete loss of function of these organs.

(3) Although the disease is extremely serious, mortality of dogs from leptospirosis seldom exceeds 10 percent of those infected. Antibiotics given early in the course of the disease may effect a cure. Owners should be advised that they can reduce exposure of their dogs by confining them to their own premises and by keeping them leashed when in places frequented by other dogs. This is particularly important, because even those animals which recover from this disease may continue to shed the organism in their urine for some time.

(4) Prevention of leptospirosis is accomplished by immunization with a killed bivalent vaccine. This vaccine is often administered in combination with the vaccine for distemper and infectious canine hepatitis. This combination, commonly called DHL, will protect the dog from all three of these diseases for a period of one year.

COMMUNICABLE DISEASES OF DOGS AND CATS

1. In this section we will discuss some communicable diseases of dogs and cats. These diseases are not transmissable to man, but are readily transmitted from animal to animal. Because of the frequency with which these diseases attack unprotected dogs and cats, pets are immunized for them in the veterinary small animal clinic.

2. We will concentrate on four diseases; distemper, infectious canine hepatitis, feline distemper and feline pneumonitis.

a. Canine Distemper.

(1) Canine distemper is a virus disease which has been called the "scourge of dogdom," since it causes the death of more dogs than does any other disease. This disease, which primarily effects young animals, is caused by an air-borne virus. This virus is extremely stable, and can remain "alive" for up to 30 days outside of a host.

(2) A typical case of distemper can often be diagnosed without great difficulty; however, in the initial stages it can easily be confused with infectious canine hepatitis or with leptospirosis, which will be discussed in the following paragraphs. The characteristics of distemper most evident are:

(a) Puppies under 3 months

1. few symptoms
2. dehydration
3. bloody diarrhea

(b) Dogs over 3 months

1. Phase 1
    - incubation period 6-9 days
    - temp 104°F. for 1-2 days
    - alert, appetite diminished
    - conjunctivitis
    - clear discharge from eyes and nose
    - temperature returns to normal, no new symptoms appear for 1-2 days

2. Phase 2

- temperature rises to 103-104°F. for 2-14 days
- coughing
- diarrhea
- secondary bacterial infection
- dehydration
- greenish discharge from eyes and nose
- loss of appetite
- hard pads
- convulsions

(3) The virus of canine distemper is practically always present in dog populations. For this reason, most dogs are exposed to the disease early in life, unless they are raised in a completely isolated environment. Unless they are properly immunized, the probability of being infected is extremely high. Transmission of the disease can occur because of virus-containing droplets that are carried in the air, as well as by contaminated objects. Once an animal is exposed, the period of incubation is approximately 6 to 9 days.

(4) An animal suspected of having canine distemper should be seen by a veterinarian as soon as possible. Even with immediate attention, there is no specific cure for the disease, since it is caused by a virus and does not respond to antibiotics. Therefore, you may contribute most to a satisfactory recovery by assuring that good nursing care is provided. Of utmost concern is that the dog continues to eat, which at times may require hand feeding. If the dog does not eat, it loses strength quickly and becomes more susceptible to secondary infections. By being in good condition, the dog stands a better change of recovery.

b. Infectious Canine Hepatitis.

(1) Another highly contagious virus disease of dogs, infectious canine hepatitis, may attack dogs of all ages; most often, however, young animals are affected. It may be spread from animal to animal through contaminated feeding and drinking utensils, direct physical contact, urine, houseflies or dirt. The early symptoms of infectious canine hepatitis are difficult to differentiate from those of distemper. To make diagnosis more difficult, animals are sometimes infected by the viruses of both infectious canine hepatitis and distemper at the same time. As the disease progresses, there may be icterus (yellow color) of the sclera and conjunctiva of the eye.

(2) Hepatitis in dogs varies from mild cases of only a slight fever to illness that results in death. It is probable that over 80 percent of all dogs have been exposed to the disease by the time they are a year old. Symptoms of this disease, after an incubation time of 6-9 days are as follows:

- temperature of 104° or higher for 6-9 days
- loss of appetite
- intense thirst

- firey red mucous membranes
- abdominal tenderness
- icterus (yellowish eyes)
- temporary corneal opacity (blue eye)

(3) A dog which exhibits the signs and symptoms of infectious canine hepatitis must be examined and treated by a veterinarian as early as possible if recovery is expected. Again, good nursing care is the recommended treatment, as this is a virus disease with no known cure. Once recovered, however, dogs can serve as "recovered carriers" - spreading germs in the urine.

c. Feline Distemper.

(1) Like canine distemper, feline distemper is a highly contagious disease. The disease is caused by a virus which attacks principally members of the cat family; the raccoon is the only species outside the cat family known to be susceptible. The disease is known by such other names as feline panleucopenia, cat plague, feline infectious enteritis, and cat fever. Sometimes the disease appears to be seasonal. However, its incidence is more nearly related to the number of susceptible animals in the region. In other words, any increase in the cat population of a particular region may be accompanied by an outbreak of feline distemper. Any cat that shows generalized evidence of illness and fever must be suspected of having distemper. The suspected animals should be examined by the veterinarian as soon as possible.

(2) Affected animals can spread the disease rapidly because all their secretions and excretions contain the virus. The infection is spread through direct contact or by virus-contaminated materials or equipment. The incubation period varies from 4 to 10 days. Infection by the virus initiates a fever. The animal will then exhibit the following symptoms:

- loss of appetite
- vomiting
- weak and depressed
- diarrhea
- extreme dehydration

The disease will usually run its course in approximately a week. Of the cases of feline distemper, 60 to 90 percent of the animals affected may be lost, with kittens being particularly difficult to save.

(3) Medication during the early treatment should not be given orally because vomiting will prevent effective action. The course of treatment should attempt to correct dehydration, provide nutrients, and prevent secondary infection. The veterinarian will perform treatment and prescribe medication to correct blood conditions of the infected animals. Cats that recover from the disease are thereafter immune.

d. Feline Pneumonitis.

(1) Feline pneumonitis is one of a group of highly contagious respiratory infections. Characteristics of the disease include sneezing, inflammation of the mucous membrane of the nose, the secretion and flowing of tears from the eyes, and inflammation of the membranes of the eyes. Transmission of the virus of feline pneumonitis occurs naturally in droplets in the air. Incubation requires from 6 to 10 days. Infection of a cat may cause an initial temperature rise to 105°F before it subsides to fluctuate between normal and 103°F.

(2) Pneumonitis is more severe in young kittens. In many adult cases, it may be limited to sneezing, a slight inflammation of membranes, and serous discharges from the nose or mouth. It may run its course in 5 to 10 days in milder cases, but may persist for 3 to 6 weeks when severe. The mortality rate for this disease is quite low, so an infected animal's chances for recovery are usually good. However, the owner should realize that a prolonged illness will result in weight loss and other general complications which contribute to a weakened condition. The virus apparently can exist in a cat for long periods and all signs can reappear rapidly in the animal if it is placed under stress.

(3) A presumptive diagnosis can be made on the general signs of sneezing, fever, inflammation of membranes and serous discharges. For a definite diagnosis that will guide positive treatment procedures, the animal should be referred to the veterinarian. The best protection against infection of a cat with feline pneumonitis is to avoid exposure to sick cats, overcrowding and stress.

MISCELLANEOUS DISORDERS OF DOGS AND CATS

1. Dermatitis. Dermatitis is inflammation of the skin. Skin conditions that exhibit the characteristic signs of this disease vary rather widely and many include redness due to congestion of capillaries; the presence of excessive fluids as indicated by blisters, weeping and excretions; small elevations of the skin that are solid, or are filled with pus or lymph; and scale or crust formations. Dermatitis may be produced by a variety of external irritations. However, it often occurs without the apparent existence of any irritant. In these instances, anything in the animal's environment can be suspected. These unseen irritants are often one of an exceptionally large number of allergens that can produce dermatitis. Exposure to certain light rays can also result in irritations that develop in some animals because of hereditary traits. Evidence of itching, as indicated by scratching, calls first attention to infections of the skin. When this occurs, refer the animal to the veterinarian, who will determine the proper treatment. Elimination of the cause, where it is apparent, will usually result in recovery. Clipping the hair in the affected area may promote satisfactory treatment. Sedatives can be administered and protective collars and hobbles may be applied to prevent the animal from self-inflicted irritation as a result of scratching and licking.

2. Conjunctivitis. The delicate membrane that lines the eyelid and covers the front of the eyeball is the conjunctiva. Inflammation of these membranes is conjunctivitis. When the conjunctiva is affected, various signs will be exhibited according to the cause of the inflammation. The observable symptoms include swelling, redness, and discharge containing watery secretions or pus. The disease can occur in one eye only, or in both. Conjunctivitis may be caused by bacteria, viruses, foreign material, and chemical agents (soaps, fungicides, etc.). Treatment must first be directed toward removal of these causative agents. In order that the cause be correctly identified, the animal should be examined by the veterinarian as early in the development of the disease as is possible. Frequent cleansing of the affected membranes with appropriate solutions, as prescribed by the veterinarian, promotes recovery in most cases. Generally, animals suffering from conjunctivitis will be more comfortable and will heal more rapidly if placed in a darkened area. Sedation and restraint are sometimes required to prevent self-injury.

3. Otitis.

a. Of the diseases which affect small animals, it is possible that those of the ear are among the most frequent to occur. Otitis is one of these diseases. The most common otitis (Otitis externa) is an inflammation of the skin within the ear canal. The disease is more common in dogs than in other domestic animals. Of the breeds of dogs, those with hanging ears and longer hair seem more susceptible.

b. Animals with otitis usually exhibit restlessness, and may scratch or rub their ears. They may also shake their head or may incline it to the affected side. The original infection may be aggravated by a secondary condition brought on by scratching, rubbing, and head shaking. Examination of the ear will usually reveal reddened skin and a yellowish discharge.

c. Treatment of the ear should be attempted only by a veterinarian. It may be necessary to clean the ear if the infection causes an accumulation of dried exudate. The cleaning must be done very gently to prevent further injury. In general, conservative treatment is desirable because overtreatment often results in unnecessary probing and swabbing.

4. Gingivitis.

a. Most diseases of the mouth can cause gingivitis by spreading inflammation to the gums. Other causes include the secondary action of systemic diseases, physical injury, foreign bodies, and dental caries. However, the most common cause is the accumulation of calculus deposits on the neck of the teeth.

b. Gingivitis can be recognized by bright red, inflamed gingival tissue surrounding the neck of the teeth. The gums become swollen and ulcerated in the more advanced cases, and they may bleed easily. Because an inflammation may be caused by a more serious condition, these signs must not be accepted to be conclusive for diagnosis. [illegible]tead, the animal should be examined by the veterinarian so that proper treatment [illegible] be applied.

c. In any case, oral hygiene in the form of mouth washes is a proper treatment. Where the infection is secondary, of course, the treatment must be directed toward the primary disease. If calculus deposits or dental caries are the cause of gingivitis, they must be removed by the veterinarian.

5. Gastroenteritis.

a. Gastritis and entertitis are diseases which involve inflammation of the mucous membranes of the stomach and small intestine, respectively. These diseases may occur separately, but often both the stomach and small intestine are affected simultaneously. When this is the case, the disease is properly referred to as gastroenteritis. While gastroenteritis is associated with infectious diseases such as distemper, hepatitis, and leptospirosis, it can also be caused by overeating, spoiled food, indigestible food or irritating drugs or chemicals.

b. Vomiting is the most common sign of inflammation in the stomach, while diarrhea is usually evident with inflammation in the lower intestine. These conditions are often accompanied by pain as indicated by restlessness of the animal and its reaction to pressure applied to the abdomen. Severe infections of gastroenteritis may cause the vomitus to contain blood. If bleeding occurs in the upper portion of the small intestine, the feces may be dark green or black; bleeding in the lower portion will give a blood-streaked appearance. Also, the feces may be watery and exceptionally foul smelling.

c. Treatment of this disease must be as dircted by the veterinarian. In addition to any medication that he may prescribe, the animal's diet will usually be changed. All food and water may be withheld for as much as a day. The animal's thirst can be controlled by allowing it to lick ice cubes. When the animal is again allowed to eat, only such foods as boiled milk or broth are first included in the diet. The diet is gradually changed, using bland foods like oatmeal, soft-boiled eggs, and cooked rice and milk puddings until it is returned to normal.

6. Obstruction of anal sacs. A small sac-like gland which has a short duct, or opening, just inside the anus is located on each side of the rectum. The function of these anal sacs is to secrete an oily, odiferous material which helps to lubricate the stool and which is responsible for much of the characteristic odor of dog feces. These ducts often become obstructed, causing the secretion to collect in the sacs. This, in turn, causes itching and makes the dog bite at his anus and rub it along the ground. This action is often mistaken for a symptom of worms. In some cases, the accumulated secretion may be gently massaged out; in other cases, the sacs and ducts must be flushed. Only a veterinarian may flush the sacs and ducts, but he may teach you to massage out the accumulated secretion. Sometimes an anal sac may become infected. When this happens, painful swelling develops. If the sac is not treated, it may abscess and rupture, leaving an opening (hole) alongside the anus. The veterinarian should treat an abscessed anal sac as soon as it is detected.

DIAGNOSTIC PROCEDURES

An area in which you will be of invaluable assistance to the veterinarian is in the diagnosis of parasites. There are several important diagnostic procedures that you must learn in order to properly identify parasites in dogs and cats. We will discuss techniques for diagnosing internal and external parasites.

1. Intestinal parasites. This group can be diagnosed by examining the feces under a miscroscope; for the eggs of the parasite are mixed in the fecal material.

a. Direct smear method. Mix a small portion of the fecal material (about the size of the head of a match) with 1 or 2 drops of water on a slide and cover it with a cover-slip. Then examine the entire area under the coverslip under low power.

(1) Advantage of direct smear. This procedure is very simple and takes very little time.

(2) Disadvantages of direct smear.

(a) This method is effective only when the animal is heavily parasitized. (If there were a total of 50,000 eggs in the stool, an average of one per slide might be found.)

(b) A negative examination is not proof that parasitism does not exist. Therefore, another procedure must be performed.

(c) The fecal debris present makes it difficult to see the eggs.

b. Concentration methods. In this technique, the eggs of a larger sample of feces are concentrated into a smaller area for ease of diagnosis. The principle is that the eggs are "floated" to the top of the "flotation solution" and the surface, containing the eggs, is transferred to a slide and examined under the miscroscope. The principle of flotation is that if salts or sugars are added to water, the weight (specific gravity) of the solution is increased. When the specific gravity of the solution becomes greater than the specific gravity of parasite eggs, the latter rise to the surface.

Specific gravity of water = 1.0

Specific gravity of hookworm eggs = 1.005

Specific gravity of ascarid eggs = 1.110

Specific gravity of whipworm eggs = 1.150

Specific gravity of flotation fluid = 1.20

(1) Procedures.

(a) Comminute a pecan sized sample of fecal material in about 10 ml of water.

(b) Strain through 2 layers of wet gauze into a centrifuge tube and centrifuge for 1 minute at 2500 rpm.

(c) Discard the supernatant and break up the sediment with an applicator stick.

(d) Add sufficient $ZNSO_4$ (specific gravity 1.18 - 1.20) to fill the tube to within 1/2 inch of the top.

(e) Mix the sediment very thoroughly with an applicator stick and centrifuge at 2500 rpm for 1 minute.

(f) Carefully remove the tube from the centrifuge and without agitating the contents place it in vertical position in a rack.

(g) Wait about 2 minutes and touch the surface film with a wire loop. Transfer several loopsful to a glass slide.

(h) Cover with a coverslip and examine under low power.

(2) Advantages - All the eggs in a large amount of fecal material are concentrated.

(3) Disadvantages - This procedure is time-consuming.

2. Heartworm. Heartworm infection in dogs is diagnosed by observing the microfillaria in a sample of blood. The microfillaria are a microscopic, wormlike stage in the life cycle of the heartworm, Dirofillaria immitis. The official diagnostic test recognized by the Air Force is the Knott's Concentration Test. It is used for all military dogs as well as those dogs being considered for procurement by the Department of Defense. Let's look at the steps used in performing the Knott's Concentration Test for the diagnosis of heartworms.

a. Draw 1 ml of blood by venipuncture and mix with 10 ml of a 2% solution of formalin. (To make a 2% solution of formalin, mix 2 cc of formalin in 38 cc of water.)

b. Centrifuge for 5 minutes at 1500 rpm.

c. Pour off the supernatant without disturbing the sediment.

d. Mix the sediment with an equal part of 1:1000 methylene blue.

e. Transfer a portion of the sediment to a clean slide, apply a coverslip, and examine under low power. Confirm findings under a higher power.

3. External Parasites. There are many external parasites, often called ectoparasites, that affect dogs and cats. Most of these can be diagnosed by visual examination of the skin and hair coat. Examples of these easily observed parasites are ticks, fleas and lice. Mites, on the other hand, are a little more difficult to diagnose.

a. Ear mites (otodectes). Ear mites can be diagnosed by swabbing the ear with mineral oil. The material removed, a foul smelling tar-like substance, can be spread onto a slide and examined under the low power of a microscope.

b. Mange mites (Demodectes and Sarcoptes). These mites, which burrow into the skin causing a condition known as mange, can be diagnosed with the use of the skin scraping technique.

(1) Select a site at the outer edge of a recent lesion and moisten the site with water or mineral oil so that the collected material will adhere to the knife.

(2) Scrape deeply enough with a scapel to produce pinpoint hemorrhages (capillary bleeding).

(3) Transfer the specimen collected on the knife to a microscope slide and add 1 or 2 drops of mineral oil to the preparation.

(4) Add 1 or 2 drops of sodium hydroxide (NaOH) to dissolve the cellular debris.

(5) Cover with coverslip and examine under low power.

STUDY GUIDE AND WORKBOOK 3ABR90830-XI-5

DEPARTMENT OF VETERINARY MEDICINE

VETERINARY SPECIALIST

PARASITOLOGY

December 1974

4-1

SCHOOL OF HEALTH CARE SCIENCES, USAF
SHEPPARD AIR FORCE BASE, TEXAS

Designed For ATC Course Use

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Department of Veterinary Medicine
School of Health Care Sciences, USAF
Sheppard Air Force Base, Texas

SW 3ABR90830-XI-5
December 1974

PARASITOLOGY

OBJECTIVES

When you have completed this study guide and workbook entitled "Parasitology", you should be able to:

a. Identify the common parasites of dogs and cats.

b. Diagram the life cycle of the common parasites of dogs and cats.

c. Identify the symptoms of the common parasites of dogs and cats.

d. Describe the public health significance of the common parasites of dogs and cats.

e. Name the procedures for diagnosing the common parasites of dogs and cats.

f. List the procedures for the treatment and control of the common parasites of dogs and cats.

INTRODUCTION

In this lesson the description, symptoms of infection, modes of transmission, life cycles, public health significance, treatment, and control of many of the most common internal and external parasites of dogs and cats will be presented.

To assist in the diagnosis, treatment, and control of parasite infections, you will need to have a thorough knowledge of the common parasites that infect pets.

INSTRUCTIONS

This instructional program is a combination audio-visual presentation and student workbook. The audio-visual presentation is segmented. At selected intervals, within the lesson, you will be told to complete a project. The project may consist of your sketching the projected image or completing a workbook exercise. When you have completed the project, you will continue the lesson.

INFORMATION

"Can you give me something for my dog? I think he's got worms." This is a request you will hear time and time again during your career as a Veterinary Specialist. You will also be asked such things as: "What's making these bald spots on my cat?", "Can my kids get worms from my dog?", and even "By the way, just what are these worms my dog has?".

All these questions are referring to one common problem of pets - parasites! Parasites come in many shapes and sizes. Some live inside the pet while others live on the outside of the skin. "These worms," we have just referred to, are internal parasites. What's making those bald spots on that cat? Parasites again, but this time they are probably external parasites. There are many types of parasites that affect pets and they are a problem in need of constant attention. An important part of your job will be answering questions just like those above. You will be helping people keep their pets healthy and free from parasites. You will go a step further than just answering questions; you will assist in the diagnosis, treatment, and control of parasitic infections.

To carry out this part of your mission, you will need to have a good knowledge of the common parasites that infect pets. The purpose of this lesson is to do just that! It will acquaint you with the description, symptoms of infection, modes of transmission, life cycles, public health significance, treatment, and control of many of the most common internal and external parasites of dogs and cats.

INTERNAL PARASITES OF DOGS AND CATS

As we said earlier, parasites can be grouped into two general catagories: internal parasites - those that live inside the body, and external parasites - those that exist on the animal's outer body surface. Let's begin our study with those classified as internal parasites.

ASCARIDS (TOXOCARA)

Ascarids, often called roundworms, are slender, round-bodied worms that live in the small intestine of their host. They vary in length from species to species; the dog and cat roundworms that we are concerned with range from 2 to 4 inches for male worms and 4 to 7 inches for females.

Life Cycle

Let's study the life cycle of the roundworm Toxocara and trace the events that take place during its development from the egg stage to the adult parasite.

The adult roundworm lives in the small intestine of the dog. For this parasite the dog is the definitive host. That is, the host in which the adult parasite lives. The worms mate and the female expels fertilized eggs, which mix with the contents of the intestine.

Next the eggs are passed from the dog's body in the feces. Under the correct conditions (shade, warmth, and moisture), the larvae (an immature stage in the life history of the parasite) develop. Once the larvae develop within the eggs, they can infect a dog. This can happen when a dog accidently eats food contaminated with worm eggs. An example would be the dog eating food from the ground.

After they are swallowed, the larvae penetrate the wall of the intestine, enter the circulatory system and migrate to the lungs. In the lungs, they leave the blood vessels and make their way up the trachea into the larynx where they are swallowed. Then they migrate into the small intestine where they develop into mature adults. This completes their life cycle.

Migration of larvae within the tissues of pregnant females (called bitches) can lead to the infection of the unborn pups. Therefore, when the puppies are whelped (born) they may be infected. Within three weeks, the parasites could produce eggs which would be passed outside the puppies when they defecate. By licking her pups the bitch will ingest large numbers of eggs and become more heavily parasitized. Consequently, you should advise pet owners to treat the bitch just prior to breeding; thereby preventing the problem of infected, newborn puppies, as well as massive infection of the mother.

Clinical Findings

Roundworm infection is a disorder primarily a disease of young animals. The most obvious evidence of infection in young animals is a lack of growth, a dull haircoat, and a pot bellied appearance. Worms may be vomited or passed in the feces. As noted in the life cycle, the larvae migrate through the tissues of the lungs and cause damage which can lead to respiratory distress. On rare occasions, death may result from a rupture or obstruction of the intestine. Adult dogs usually withstand roundworm infections with little trouble, however, heavy infections may cause hair loss, poor hair coat, (that is a dry and dull coat), restlessness, and diarrhea.

Public Health Significance

In this section, we will be concerned with the effects of the parasite on the pet owner, rather than the effects of the parasite on the pet. How do dog or cat roundworms affect man? Look again at the life cycle of this parasite. The eggs pass from the animal in the feces and under the proper conditions (moisture, shade, and warmth), further development will occur. After a variable period of time each egg will contain an infective larva. The ingestion of these eggs by humans will result in a condition known as visceral larva migrans. The eggs hatch out after they enter the digestive tract. The emerging larvae then penetrate the intestine and migrate through the body. They wander indiscriminately among the tissues in an unsuccessful search for a suitable site to complete their development. Since man is not a normal host, roundworm larvae do not develop into adults, as they would in an animal host. Remember, the species of roundworms that parasitize dogs and cats only infect humans accidently. When this happens, the life cycle of the parasite comes to a dead end. An abnormal host of this type is commonly referred to as a dead end host.

Visceral larva migrans generally affects very small children. The primary way infection occurs is by eating soil that is heavily contaminated with roundworm eggs. Such soil is likely to be found within the range of the dog-chain of a doghouse and at sites where unconfined dogs defecate. Extremely high concentrations of eggs may be found in the nests of female dogs that have litters of puppies.

Any area of confinement with a dirt floor, especially one occupied by young pups, is almost certain to be contaminated. Cats will defecate in children's sandboxes or in moist, loose soil under porches and in old cellars and sheds. Consequently, to prevent infection, children should not be allowed to play where dogs or cats habitually defecate.

Diagnosis

Adult roundworms mate in the small intestine of the host and the females produce viable eggs. The eggs mix with fecal material and are eventually passed from the body. Diagnosis of infection in dogs and cats is made by finding eggs in the feces by microscopic examination.

Control

The following section on the control of roundworms will apply, with a few modifications, to the control of most internal parasites. Therefore, with noted exceptions, this description will serve as the control procedure for several other internal parasites to be discussed in this lesson.

The first step in controlling any internal parasite is treating the infected animal. The drugs used for treatment, grouped together, are called anthelmintics (ant - against, helminths - worms). The veterinarian will choose the one he thinks will best fit each situation. Most medications affect only adult parasites so treatment will have to be repeated within two weeks to eliminate adults that were in the larval stage at the time of the first treatment. There are a variety of drugs available for this purpose.

Unfortunately, elimination of the worms from the family pet does not constitute control. Look at the life cycle of roundworms again. Infective eggs exist in the soil where dogs and cats defecate. Over a period of time the soil can become heavily contaminated with eggs. This poses a very real hazard of reinfection. If, after treatment, the dog or cat continues to eat, sleep, and run in the contaminated area, the arrival will become infected again.

Unless proper care is taken to insure good sanitation in the pets living area, this cycle of infection - treatment - reinfection - could go on indefinitely. Consequently, people who are having their pet treated for worms must understand the importance of good sanitation as a control measure. Runs and kennels should be cleaned regularly. Dog feces should not be allowed to remain on the ground day after day, as this will allow for the build-up of eggs in the soil.

HOOKWORMS (ANCYLOSTOMA)

Adult hookworms are found in the small intestine of dogs and cats. They are quite slender and are about 1/2-inch in length. They are fairly rigid, and their color ranges from grey to red, depending on the presence of blood in the gut of the worm. It has been reported that each hookworm will suck one cubic centimeter of blood per day. In cases where there are great numbers of hookworms present, a large proportion of the host's blood will be lost each day. This loss of blood gives rise to an anemic state which generally accompanies heavy hookworm infections. Hookworms frequently infect dogs in the summer, especially those that are confined on a relatively small area of moist ground.

Life Cycle

Note the following important points in life cycle of the hookworm:

1. Larvae develop within the eggs under the proper conditions:
    a. Shade.
    b. Moisture.
    c. Warmth.
2. The eggs hatch on the ground, liberating the infective larvae.
3. There are two modes by which dogs can become infected:
    a. By ingestion of the larvae.
    b. By penetration of larvae through the skin.

A final point concerning the life cycle is that if a pregnant bitch is infected with hookworms, the unborn pups may also become infected. Then, as with roundworms, pups may already have hookworm infections at the time they are born.

Clinical Signs

The presence of a few worms in a mature dog may not cause any symptoms of hookworm disease. On the other hand, a relatively small number of worms may cause disease in a small puppy.

Hookworm infection is seen in dogs of all ages. Puppies infected during fetal development may have a sudden onset of severe anemia, coma, and even death within three weeks after birth. The primary signs in older dogs are rapid anemia (evidenced by pale mucous membranes), accompanied by general weakness and emaciation and poor haircoat. Growth is stunted and the coat becomes dry and harsh. There may be itching of the skin due to penetration by the infective larvae of the hookworm. Often the dog has diarrhea and the feces contains blood which is usually tan-like in nature due to the action of digestive juices in the small intestine. In fatal cases, death follows a period of pronounced weakness, particularly in the hindquarters, and extreme paleness of mucous membranes.

Public Health Significance

Hookworm larvae build-up in moist ground areas where infected dogs and cats continually defecate. You will recall from the life cycle of hookworms that one way these infective larvae gain entrance to the host's body is by penetrating the skin. Animal hosts are not the only organisms susceptible to penetration by these larvae; man too may be infected by these tiny skin-piercing worms!

The larvae of the dog or cat hookworm cannot complete its life cycle after it accidently penetrates the skin of man. Instead, it remains within or just beneath the skin. The condition the larvae causes is known as cutaneous larva migrans or sometimes as "creeping eruption." This disease is characterized by inflammation of the skin in the form of thin red lines that mark the path of the migrating larvae. The presence of the larvae causes severe itching. Many infections arise when a person comes in contact with contaminated, damp, sand soil. Infection occurs more frequently in people living in the Southeastern United States. Adults whose jobs bring them in constant contact with the soil are affected more than others. A fairly common source for children is an outside sandbox in which infected cats might frequently defecate.

The owners of animals treated for hookworms should be warned of the potential danger of a family member contracting cutaneous larva migrans. It should be pointed out that damp sandy soil where their pet was allowed to defecate could have a build-up of infective larvae. They should further be warned that any skin contact with such an area could very well lead to the contracting of cutaneous larva migrans.

The adult hookworms mate in the small intestine of the host and the female expels her eggs. The eggs, mixed with the fecal material, pass from the body. The diagnosis of hookworm infection in dogs and cats is by microscopic examination of feces for the presence of hookworm eggs.

Control

Control of hookworms consists of anthelmintic treatment of pets and proper sanitation of pets' surroundings to prevent the build-up of infective larvae are necessary for control.

WHIPWORMS (TRICHURIS)

Whipworms are found in the caecum of the dog. The worms are 2 to 3 inches in length with a threadlike anterior end and a thick posterior end. The anterior end is deeply embedded in the lining of the caecum and blood of the dog is taken into the gastrointestinal tract of the parasite.

Life Cycle

By observing this diagram you can see that the life cycle of the whipworm is quite simple and straightforward. Eggs, passed in the feces, are dispersed on the ground. A dog becomes infected when he consumes the eggs by eating food off of the ground or by gnawing bones contaminated with dirt. They hatch in the stomach and migrate through the small intestine and into the caecum. The life cycle is completed when the larvae develop into sexually mature adults.

Clinical Signs

Most whipworm infections are asymptomatic, that is, show no signs or symptoms. Very heavy infections though, may cause occasional periods of diarrhea alternating with normal stools. The diarrheal stools often contain mucus and bright red blood. The blood is bright red because it is not subjected to the digestive juices of the small intestine, as was the case in hookworm infection.

Diagnosis

The adult worms mate and the female expels eggs which mix with the feces. Diagnosis is by microscopic examination of the feces for the presence of the eggs.

Control

Whipworms are controlled by anthelmintics and proper sanitation of dogs' surroundings.

TAPEWORMS (DIPYLIDIUM, TAENIA)

The adult tapeworm lives in the small intestine of its host. The body of this parasite is composed of a scolex, or head, at the anterior end and a chain of proglottids (segments).

The scolex bears sucker devices sometimes lined with hooks, which are used to anchor the worm to the intestine.

The proglottids are reproductive units containing both the male and female sex organs. As the proglottids mature, they move slowly towards the posterior end of the worm. This occurs because the parasite grows from the anterior (head) end and the newly formed segments displace the older ones.

Fertilization takes place after the segments mature. At the time the proglottid reaches the posterior end of the chain it is gravid, that is, full of fertilized eggs. We will observe the fate of these gravid proglottids in the life cycle section.

Tapeworms have no digestive organs or mouth. Instead, nutrients are absorbed through the "skin" of the worm. The nutrients of the tapeworm are the digested food in the intestine of the host. The prime importance of tapeworms is that they rob the host of its nutrients by absorbing them before they are absorbed through the intestines of the host.

Life Cycle

There are two tapeworms we will concern ourselves with at this time.

Taenia

You should note an important feature in the life cycle of this parasite - two animals serving as host.

First, the adult parasite lives in the small intestine of a dog. The dog is the definitive host.

Second, proglottids pass from the dog in the feces. The eggs are eventually liberated and contaminate the surrounding vegetation.

Next, a rabbit eats the contaminated plants. Introduction of the eggs into the rabbit's digestive system causes the eggs to hatch into larvae. Those eggs remaining on vegetation, that are not eaten by a rabbit, will never develop any further. The rabbit serves as the intermediate host. That is, a host utilized in an intermediate stage of the life cycle which is necessary for the continuing development of the parasite.

It is important to note that this parasite does not develop to maturity in the intermediate host.

Follow the life cycle further; you will see that the larvae form cysts (dormant or "resting" larvae) in the mesentary of the rabbit.

A dog becomes infected with this tapeworm when it eats the intestines of the rabbit. The cysts dissolves and in the dog the larvae continue development and migrates into the small intestine.

Dipylidium

Study the life cycle diagrammed here. The flea is the intermediate host of this tapeworm. Unless the tapeworm eggs are eaten by a flea larvae, they will not develop into adults. Also, a dog cannot become infected with this parasite unless he eats a flea that contains a tapeworm larva. The life cycle would not be completed if any stage were bypassed. For example, if a dog ate tapeworm eggs, they would not develop into a larva or an adult.

Clinical Signs

In general, tapeworms are not very harmful to dogs and cats. Clinical signs vary greatly, usually consisting of mild gastrointestinal upsets. In heavy infections of young animals there is diarrhea, sometimes alternating with constipation. Mature segments that have broken from the tapeworm may migrate through the anus and be noticed on the hairs around the anal area. Irritation may occur causing the dog to drag its anus over the ground. Be advised that uninfected dogs also drag themselves on the ground because of irritation caused by swollen anal glands. Impacted anal glands are, in fact, by far the most common cause of this dragging occurrence in dogs.

Public Health Significance

From the life cycle of the tapeworm Dipylidium and recall that the flea is the intermediate host. Humans, especially children, may swallow the fleas containing the larval stage of the worm and become infected.

Diagnosis

As was previously mentioned, the proglottids of tapeworms sometimes migrate from the anus onto the hairs of the surrounding areas. This makes diagnosis quite easy in some cases. Another way to determine if a dog or cat is infected with a tapeworm is by visual examination of the feces for segments. There are differences in the shape of the proglottids of the two tapeworms discussed. Correct control of tapeworms depends on your knowing with which type the dog is infected.

Control

Following the identification and treatment for tapeworm infection, control measures must be instituted. In the case of Dipylidium infection, the animal must be kept free of fleas. There are a variety of control methods, some of which will be discussed in a later section. In preventing infection with Taenia the dog must not be allowed to eat the viscera of rabbits. This often happens when hunters "reward" their dogs for a job well done. It is much more difficult to control this in dogs that hunt and kill rabbits on their own.

HEARTWORM (DIROFILARIA IMMITIS)

The adult worm lives in the heart and often in the pulmonary artery (which runs from the heart to the lungs) of infected dogs. The adults may be up to nearly 1 foot long. The microscopic larvae, called microfilariae, may be found throughout the entire circulatory system.

Canine heartworm infection is a major problem along the Atlantic and Gulf coasts where mosquitoes (the intermediate host) are prevalent. A lower frequency occurs in the midwest and in the north central states. Heartworms are a major problem in military working dogs located in these areas and for those stationed in overseas tropical areas such as Southeast Asia.

Life Cycle

When a mosquito bites an infected dog, it consumes microfilariae in its blood neal. Inside the mosquito, the microfilariae undergo developmental changes. After approximately 15-35 days, the mosquito bites another dog and the microfilariae are transferred into this dog. Within 7 to 9 months after "injection," the microfilariae develop into adults which localize in the heart. At this time, they are capable of mating and producing live larvae.

Clinical Signs

Often, dogs may be infected with heartworms and not show any clinical signs other than microfilariae in the blood. In heavy infections, the worms cause circulatory distress due to the adult worms impairing the action of the valves in the right side of the heart.

The clinical signs depend on the number of worms infecting the dog with a chronic cough and lack of stamina being most common. With time, signs of heart trouble such as rapid breathing, a heart murmur, and collapse after exercise may develop.

Heartworm Diagnosis

As we said, the heartworm microfilariae circulate through the dog's body by way of the blood stream. You can detect these parasites by examining a sample of blood under the microscope. The official test performed in the military is the Knott's concentration test. With this procedure you concentrate all the microfilariae from a 2 cc blood sample into one or two drops. You can easily make a correct diagnosis by observing that concentrated drop under the microscope.

Control

It would seem that a most effective means of controlling this parasite would be the control of its intermediate host, the mosquito. This approach, however, is very impractical, as is the separation of dogs and mosquitoes. The methods used, therefore, utilize detection of larvae in the blood and treatment for both the larvae and the adults. This method proves to be the most practical means of control. Military working dogs are examined prior to acceptance and none with a positive diagnosis or any history of heartworms are purchased. Military dogs are examined for heartworm every 6 months. Those with positive results are first treated with a compound to kill the adults. This is followed by another treatment aimed at killing the microfilariae in the blood. As the worms die they are carried by the blood stream to the lungs, where they disintegrate and are slowly absorbed. Further control measures include the use of food containing heartworm medications.

Dogs with heavy infections may die due to respiratory failure precipitated by the large number of dead worms entering the lungs.

COCCIDIOSIS

Coccidiosis is a condition caused by any of a group of protozoan parasites infecting the lining of the intestine.

Clinical Signs

Diarrhea is the most prominent sign of coccidiosis. Often this will be accompanied by the presence of blood, mucus, or shreds of intestinal lining. Because of severe diarrhea, the animals become dehydrated, weak, and depressed and lose their appetites.

Diagnosis

Microscopic examination of the feces for cyst-like cells (a stage of their life cycle), constitutes positive diagnosis of coccidiosis. Look at these cysts (b and c) and compare their size with that of a roundworm ova (a). Also note that b and c, which are different species of coccidia, are different sizes.

Control

Coccidiosis is usually prevalent in dogs under poor management and/or living in crowded conditions. Good sanitation and disinfection are required to control coccidiosis, especially in areas where a number of dogs are kept together.

EXTERNAL PARASITES OF DOGS AND CATS

Ticks

Ticks are small arthropods that range in size from about 1/25 of an inch for the larval or "seed tick" stage, up to about 1/2 of an inch for the blood-engorged females.

Ticks feed during all stages of their life cycle by piercing their host's skin and sucking blood. They can do this with no pain or sensation to their victim; therefore, animals and humans are usually not aware that they have ticks "attached" to them.

A serious, though not extremely common result of ticks is tick paralysis. This condition first becomes evident with an obvious lack of coordination in the hind limbs resulting in an unsteady gait. Eventually the paralysis spreads over the entire body leaving the dog completely immobilized. Further advance of the condition leads to death.

Often ticks infest the ears of dogs and cats. In large numbers they cause irritation to the ear. Dogs will hold their head in an unusual manner and will rub and scratch at the ears.

Life Cycle

The adult ticks on the dog mate and the female drops off and lays up to 9,000 eggs.

The eggs hatch into "seed ticks," the larval stage of the life cycle. These ticks crawl up on such vegetation as grass, weeds, or shrubs and await a host. This host is a thin skinned animal like a squirrel or rabbit.

After the seed ticks suck blood from their host, they drop off and undergo further development (molt) into the myphal stage. The nymphs then crawl up on vegetation and await a host to brush against them, whereby they will transfer to and eventually attach themselves to the skin.

Once the nymphs have had a blood meal they drop off their host and again molt, this time into the adult tick. As in the previous stages of the life cycle, the tick crawls up onto vegetation and awaits a new host.

Public Health Significance

Probably the most well known disease spread to humans by ticks is Rocky Mountain Spotted Fever. This once feared disease is characterized by high fever, chills, severe headaches, and muscle-joint pain.

Other diseases which may be transmitted by ticks are Q fever, tick paralysis, and tularemia.

Control

The first step in controlling ticks is their removal from the dog. If there is only a small number, they can be pulled out with forceps, using a slow, steady pull. If there are a large number on the dog, removal can be facilitated with any one of a large variety of available poisons. Poisons for killing ticks are available as dusts, sprays, or washes. Washes are the most effective because they penetrate the hair better and reach all the ticks

Removing ticks from the dog does nothing to prevent reinfestation. Ticks on the premises must be eliminated if reinfestation is to be avoided. This is not economically possible for large areas such as woods and pastures, but it is comparatively easy to kill ticks around houses, barns, and kennels.

MITES

In this section we will discuss three mites and the disorders they cause.

Sarcoptes (Mange Mite)

These mites are parasitic on a number of different domestic and wild mammals, causing a condition commonly known as "mange."

Importance

The body of these parasites pierce the skin to suck lymph and feed on skin cells. This activity produces an irritation which causes severe itching and scratching. The inflammation of the skin is accompanied by an oozing material which forms a crust on the surface. The condition is also accompanied by widespread loss of hair, and thickening and wrinkling of the skin.

Mites prefer those parts of the body that are not covered by much hair, such as on the muzzle, around the eyes and ears, and near the base of the tail of dogs and cats. If the condition is not treated and is allowed to spread, all parts of the body may eventually become affected.

Diagnosis

To diagnose the mange mite, scrape the lesion with a scalpel until pinpoint hemorrhaging is produced. The scrapings are examined microscopically for the presence of the parasites.

Treatment and Control

There are a variety of compounds available that are poisonous to mites. These can best be used as washes, dips, or sprays.

These compounds kill only the adults. Therefore, time must be allowed for the eggs to hatch and a repeat treatment must then be administered. Ten to 14 days should be allowed between a total of three treatments. Aside from external treatment, there are some compounds that can be administered orally. These get to the site of infection via the blood supply.

Further control is effected by the cleaning and disinfecting of the infected premises as well as all equipment such as combs and brushes should also be disinfected.

Public Health Significance

The Sarcoptes mange mite is occasionally transmitted to man from his pets. The first signs in man are reddening of the skin, formation of small bumps on the skin, and severe itching. The hands, wrists, and waist are the most commonly affected areas.

The owners of infected animals should be warned of this potential problem. It should be pointed out that thorough washing following handling of the animal is the best protection. If the owner of an infected animal has any suspicious skin lesions, they should be advised to contact their physician.

Demodex (Red Mange Mite)

This group of parasitic mites lives in the hair follicles causing demodectic or red mange. The mites enter the hair follicles producing loss of hair and thickening and wrinkling of the skin, which becomes scaley and reddened. This condition is accompanied by severe itching. Following these symptoms is the formation of abscesses due to secondary bacterial infection.

Because of the severe loss of appetite in advanced cases, dogs often become emaciated. This, plus poisoning from the bacteria, may lead to the death of the animal in very extreme cases.

Diagnosis

Diagnosis is by deep skin scraping identical to the procedures discussed under the Sarcoptes mite. Familiarize yourself with the shape of this mite.

Treatment

Control is often difficult and requires great patience and much care of the animal. There are many treatment procedures that have been reported, all of which entail the spreading of medication over the body of the dog, usually supplemented with an oral treatment that will reach the mites via the circulatory system.

Otodectes (Ear Mite)

Ear mites occur in the external ear canal of dogs and cats. They feed by chewing on epidermal debris. Infected animals shake their head and paw and scratch at the ears. The ears of infected animals will contain a dark brown, tar-like substance which has a foul odor.

Diagnosis

The crust can be loosened and removed with cotton swabs and mineral oil. Afterwards the mites can be found in material swabbed from the ear.

Treatment

The ear should be cleaned of wax debris and the tar-like discharge. This can be done with mineral oil or hydrogen peroxide. Following cleaning, an insecticidal cream or ointment should be smeared into the ear canal. Treatment should be repeated in one or two weeks to kill newly hatched mites.

LICE

General Features

Lice are wingless insects and are divided into two groups - those that bite and those that are blood suckers. Biting lice have mouth parts adapted for chewing. They live on the hairs and eat skin cells of their host.

Sucking lice feed exclusively on the blood or other tissue fluids of the host's body.

Importance

The effects of lice on their hosts are due primarily to the irritation they cause. Lice are most numerous during the winter months, possibly because of the longer hair coats of the hosts. The hosts become restless, they don't eat or sleep well and often injure themselves by biting and scratching the areas irritated by the lice. The coat sometimes becomes rough and shaggy and, in unattended cases, the hair will become matted. Diagnosis of lice is made by visual examination for the presence of the adults or the eggs. The eggs, called nits, are found attached to the hairs.

Control

The control of lice is relatively easy because the entire life cycle is spent on the host's body. Washes or dusts containing insecticides are the most effective means of killing this parasite. The treatment is effective for adult lice but will not kill the eggs. Consequently, treatment must be repeated about two weeks from the initial application of the medication.

FLEAS

General Features

Fleas are wingless insects with laterally compressed dark brown bodies which are approximately 1/10-inch long. Their hind legs are well-developed for jumping. Fleas are not a permanent parasite, that is, they frequently leave their hosts.

Importance

Heavy infestations of fleas are often found on animals which are in poor condition or are suffering from long lasting (chronic) diseases. Infested animals become restless and damage their coats by biting and scratching. Aside from irritation and allergic reactions at the site of the bite, secondary bacterial infections can also occur.

In addition to the immediate, or direct, effects of flea infestation, there is an added danger to the host of contracting tapeworm infection. You should recall from the section on tapeworms that the flea is the intermediate host of the common dog tapeworm, D. caninum.

Life Cycle

The female flea deposits eggs either in the bedding of the host, on the ground around where the host lives, or on the host itself. When the latter occurs, the eggs will drop off as they are not sticky.

Control

Control of fleas is difficult because the larvae develop off of the pet's body, usually in the bedding or surrounding area. The pet owner can kill the fleas on his pet, but, as the larvae develop into adults, they simply jump back onto the animal, reinfesting him. Continuous protection from flea collars is a valuable aid in controlling fleas; as is periodically washing the dog or cat's bedding. Insecticidal dusts and solutions are effective, but caution must be exercised as many of these chemicals can be toxic, in high concentrations, to dogs and cats.

RINGWORM (MICROSPORUM AND TRICHOPHYTON)

Ringworm is a fungus infection of the superficial layers of the skin, hair, and nails. It is not found in deeper tissues or internal organs.

General Features

Initially there is a superficial infection of the skin with the formation of thread-like hyphae which invade the hair follicles.

Infected hairs lose their luster, become brittle, and break off, leaving stumps.

Infection usually is a result of exposure to other infected animals or to contaminated premises, and occasionally to exposure to infected people.

Young animals appear to be more susceptible than older animals.

Clinical Signs

On dogs, lesions generally affect the head and forequarters at the onset of the disease. They appear as small encrustations on the skin. With time, heavy encrustations appear and are sometimes accompanied by secondary infection. When this occurs, the lesions are elevated with pustules.

If untreated, the lesions may persist for months, with new lesions developing in other areas.

Diagnosis

Lesions caused by ringworm are similar in appearance to those of some types of mange. Because of this, diagnosis must be accomplished by the demonstration of the fungus. This can be done in two ways. The first utilizes the fluorescent properties of the fungus. When illuminating the lesion with a Wood's lamp (UV light), the fungus will fluoresce. This technique is not 100% effective because not all of the species of ringworm fungi will fluoresce. The second means of identifying the fungus is the most effective. It consists of collecting and culturing a sample from the surface of the lesion on a medium that will grow only the ringworm fungi. Consequently, if any growth appears on the culture plate it has to be ringworm.

Treatment

Many topical fungicides are unable to penetrate the skin of infected animals and reach the fungus. Consequently, successful treatment usually includes fungicides taken orally. In this way, the medication will reach all the fungus by way of the blood supply.

Owners of infected pets should be advised to thoroughly wash their hands after handling their animal.

They should prevent the infected animal from coming in contact with other animals until the infection is controlled.

After the treatment of infected animals, old bedding should be burned and the quarters should be disinfected.

EXERCISE "A" (Ascarids)

1. What is another name for roundworms?
2. What is a definitive host?
3. What three conditions are necessary for roundworm larvae to develop within the egg?
4. How can dogs become infected with roundworms?
5. How is it possible for a puppy to be born (whelped) with a roundworm infection?
6. Briefly, describe the primary symptoms of roundworm infection in puppies.
7. What is visceral larva migrans?
8. How is the diagnosis of roundworms accomplished?
9. Why is good sanitation necessary for the control of roundworms?

EXERCISE "B" (Hookworms)

1. In what way are hookworms harmful to their host?

2. What three conditions are necessary for hookworm larvae to develop?

3. What are the two ways by which a dog can become infected with hookworms?

4. What are three symptoms of hookworm infection.

5. What is cutaneous larva migrans and how is it contracted?

6. How can hookworm infections be diagnosed?

EXERCISE "C" (Whipworms)

1. In what part of a whipworm-infected dog's body would you find the parasites?

2. How are whipworms contracted?

3. How is whipworm infection diagnosed?

EXERCISE "D" (Tapeworms)

1. What is the function of the scolex of a tapeworm?

2. What is contained in the proglottids of a tapeworm?

3. What is the intermediate host of the tapeworm Taenia?

4. What is the intermediate host of the tapeworm Dipylidium?

5. What are two ways to diagnose tapeworm infection in animals?

EXERCISE "E" (Heartworms)

1. What is the intermediate host of the heartworm?

2. What are the symptoms of a heartworm infection in dogs?

3. How is heartworm infection diagnosed and what is the name of the official test?

4. What is the most practical method of controlling heartworms? How is this method applied to military working dogs?

5. What is the normal sequence of events in the treatment of a heartworm infection in dogs?

EXERCISE "F" (Coccidia)

1. What type of organism is responsible for coccidiosis?

2. What organ of the dog's body is affected by coccidiosis?

3. List three major symptoms of coccidiosis?

4. How is coccidiosis diagnosed?

EXERCISE "G" (Ticks)

1. What is a "seed tick?"

2. List the stages in the tick's life cycle.

3. Name three zoonotic diseases for which the tick is the Arthropod vector.

4. How can ticks be controlled?

EXERCISE "H" (Mites)

1. What is the cause of mange?

2. Describe Sarcoptic mange.

3. What organism causes "red mange?"

4. How are mange mites diagnosed?

5. Generally, how are pets treated for mange mite infestation?

6. What are the symptoms of ear mites in a dog or cat?

EXERCISE "I" (Lice)

1. What are the two major groups of lice?

2. What effect do lice have on pets?

3. How are lice diagnosed?

4. Why are lice relatively easy to control?

5. Describe the treatment for lice.

EXERCISE "J" (Fleas)

1. What effect do fleas have on pets?

2. What internal parasite is transmitted to dogs by fleas?

3. What is the public health significance of fleas?

4. Why are fleas difficult to control?

EXERCISE "K" (Ringworm)

1. What microorganism is responsible for ringworm?

2. How is ringworm transmitted?

3. What are two ways by which ringworm can be diagnosed?

4. What are some precautions that should be taken by owners of ringworm-infected animals to prevent further contamination of people or pets?

ATC-SHEPPARD AFB TEX. 78-940